Integration Document

Endress+Hauser Instruments via HART to the PlantPAx Process Automation System

Systems with Analog I/O Modules: 1756-IF8H, 1756-OF8H, 1756-IF8IH, 1756-OF8IH, 1756-IF16H, 1769sc-OF4IH, 1794-IF8IH, 1794-OF8IH, 1794-OE8H, 1769sc-IF4IH, 1734sc-IE2CH, 1734sc-OE2CIH, 1734sc-IE4CH, 1797-OE8H

Endress+Hauser Devices: Flowmeters: Promag 53 Electromagnetic, Proline T-mass 65 Thermal, Promass 83 Coriolis Mass, Prowirl 73; Transmitters: Prosonic M Ultrasonic Level, Levelflex M Guided Radar Level, Micropilot M Radar Level, Deltabar S Differential Pressure, Prosonic S, Cerabar S Pressure, iTEMP TMT162 Temperature, iTEMP TMT182 Temperature, Liquiline M CM42
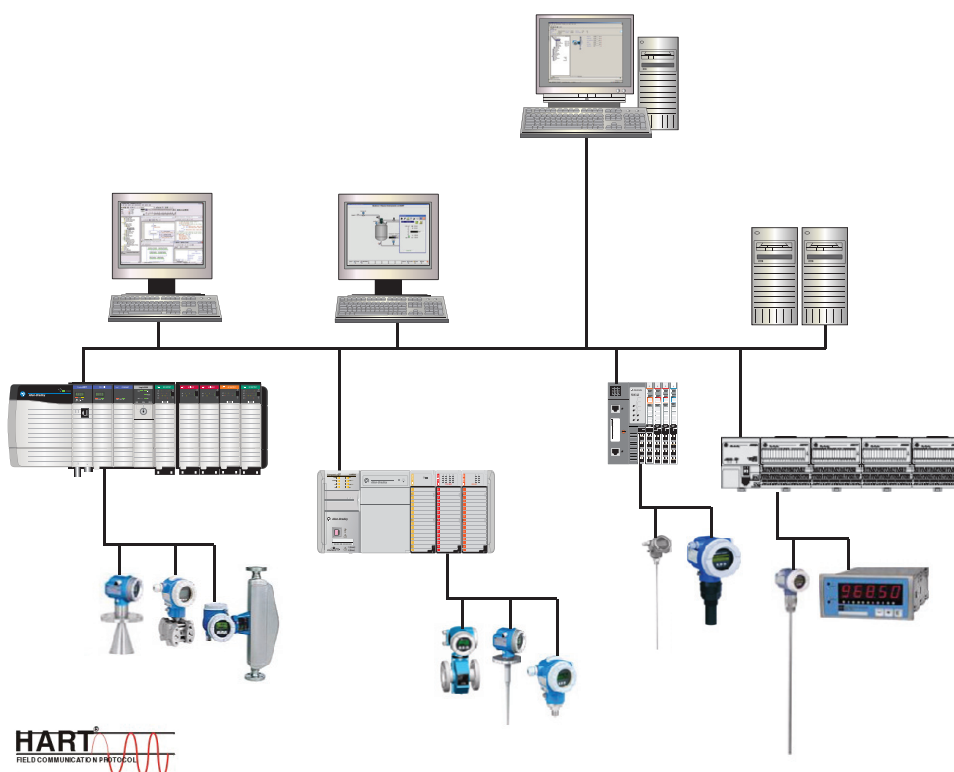
PlantPAx
Process Automation System

Endress+Hauser EH

AB Allen-Bradley · Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

⚠	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
⚠	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

⚠	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
⚠	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
PlantPAx Process Automation System replaces references to Integrated Architecture for Process Control.	9, 11
Rockwell Automation Integrated Architecture platform provides a full range of input and output modules.	12
Logix5000 controllers and FactoryTalk View software provide control and visual presentation for field instruments connected to HART modules.	13
Adds CompactLogix controllers and HART output modules to hardware components.	14
Corrects titles and links for PlantPAx system documentation.	15
Adds two tabs for the 1756-IF8IH module configuration.	31
Links to the Rockwell Automation Library of Process Objects Reference Manual, publication PROCES-RM002, replace redundant library information in Chapter 5.	74, 75

Notes:

Preferred Integration

Rockwell Automation and Endress+Hauser have strengthened their strategic alliance to provide complete process automation solutions that use best-in-class instrumentation, software, and control systems.

There are hundreds of different control components in a typical plant: controllers, remote I/O, electrical drives, safety equipment, and sensors. Each must be integrated, configured, and optimized during start-up and operation. Recognizing the challenges this creates, Rockwell Automation and Endress+Hauser are focused on providing you with scalable, off-the-shelf solutions.
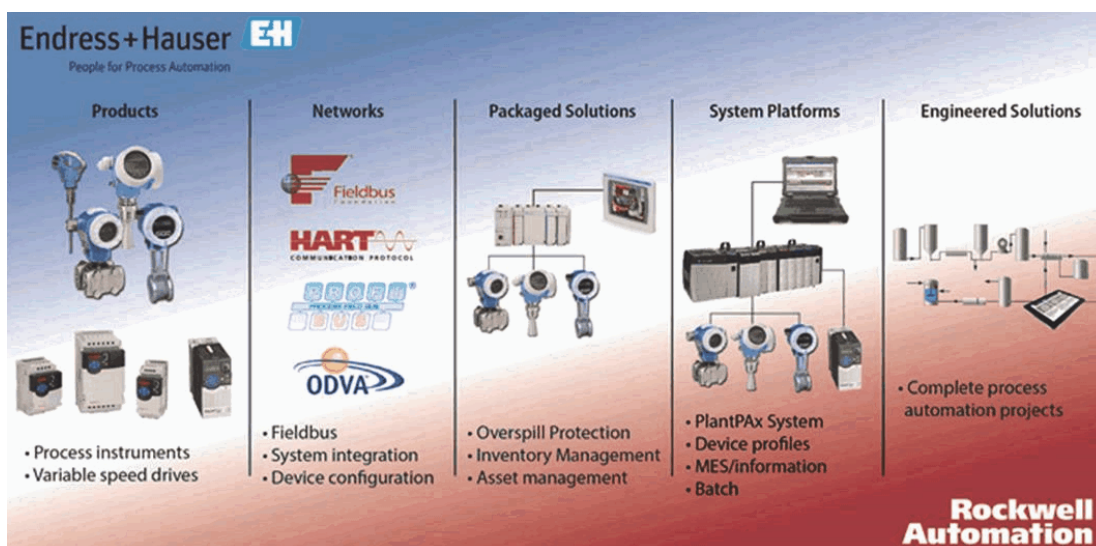
To supply robust system solutions, Rockwell Automation pre-tests many third-party manufactured HART, FOUNDATION Fieldbus, and PROFIBUS field devices in the system test laboratory for compatibility with the PlantPAx® Process Automation System. Each field device is connected to the PlantPAx system and is subjected to interoperability testing procedures similar to operating procedures in your plant. The results of each field test are recorded in a test report for integration planning purposes.

For Endress+Hauser field devices, an additional step provides an 'Integration Document' and 'Interoperability Statement' for each tested instrument. The Integration Document provides information on installation, configuration, startup, and operation of the integrated system.

The Interoperability Statement is assurance that the Endress+Hauser field device meets PlantPAx system interoperability performance measures, as jointly established by Rockwell Automation and Endress+Hauser and verified through completion of common test procedures that are performed by either company. Both the Integration Document and Interoperability Statement make sure of a no risk solution that is highlighted by ease of integration and optimum performance.

The overall mission of the alliance is to provide you with proven solutions that combine field instrumentation with fieldbus networks, such as HART, FOUNDATION Fieldbus, and PROFIBUS networks, with asset management capabilities. Add Rockwell Automation system capabilities, and you have a total engineered solution.

Through preferred integration and support of increasing requirements for plant-wide control, the alliance offers the following benefits:

- Reduced integration costs throughout engineering, commissioning, and start up
- Optimized plant availability and output
- Tested product quality and consistency
- Optimized traceability to meet regulatory demands
- Predictive maintenance through intelligent instruments

For new construction, process improvements at an existing plant, or operating cost reductions, the alliance delivers the following:

- Integration reduces risk, reduces integration costs, and protects investment with assured interoperability. Both companies believe that open systems and standardized interfaces bring maximum benefits.
- Advanced diagnostics with plant-wide support offers better visibility of plant health and easier access to instrument diagnostics, which leads to faster troubleshooting and improves decision making.
- Collaborative life cycle management to design, engineer, and start up systems faster. This collaboration increases productivity, manages information about instrumentation assets, optimizes plant assets, and results in a complete life cycle management solution.

Application Overview

This document provides a step-by-step approach to integrating Endress+Hauser devices into a PlantPAx system.

This Section	Describes
Application overview	Details about the field instrument and control system.
System details	Specifications on the required hardware and software components.
Installation	How to: • Connect the measurement instrument to the HART I/O module. • Connect a HART handheld device.
Configuration	How to: • Configure the HART I/O module. • Configure the measurement instrument and manage parameters.
Visualization	How to apply pre-designed Add-On Instructions for user interface with the instrument.

The tested HART devices are the following:

- Promass 83 flowmeter
- Promag 53 flowmeter
- Proline t-mass 65 flowmeter
- Prosonic S transmitter
- Prowirl 73 flowmeter
- Levelflex M guided radar level transmitter
- Micropilot M radar level transmitter
- Prosonic M ultrasonic level transmitter
- Liquiline M CM42 transmitter
- Cerabar S pressure transmitter
- Deltabar S differential pressure transmitter
- iTEMP TMT162 temperature transmitter
- iTEMP TMT182 temperature transmitter

The Rockwell Automation® Integrated Architecture platform provides a full range of input and output modules to span a wide variety of applications. Logix5000™ controllers use produce/consume technology that shares input information and output status to all controllers in the system.

Integrated Asset Management

Engineering Workstation (EWS)

Operator Workstation (OWS)

Process Automation System Server (PASS)

POINT I/O™ System

FLEX™ I/O System

ControlLogix® System

CompactLogix™ System

HART®
FIELD COMMUNICATION PROTOCOL
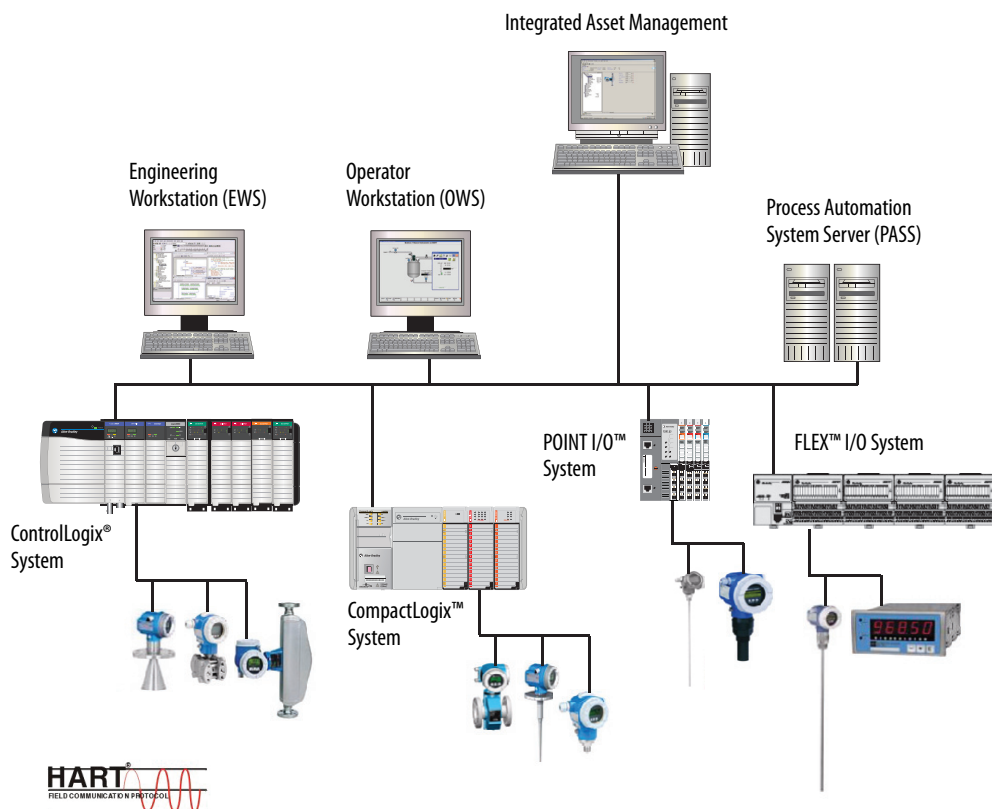
Control System

The control system includes these components:

Component	Description
Controllers	Logix5000 controllers are a modular control system that use RSLogix™ 5000 programming software to configure, program, and monitor a system.
HART I/O module	The HART analog I/O module converts between 4...20 mA analog signals and the digital values used in the controller. The I/O module automatically collects dynamic process data from the HART field instrument. The I/O module also bridges HART messages from Common Industrial Protocol (CIP) clients to HART field instruments.
Programming software	RSLogix 5000 programming software is the design and configuration tool for HART I/O that includes status and diagnostic information. The software has predefined data structures for status and configuration. A common tag database in the controller permits HMI development to directly reference I/O and controller tags without the need to manage another database in your HMI software.
Operating software	FactoryTalk® View Site Edition (SE) and Machine Edition (ME) software are visualization software programs for presenting information from manufacturing operations throughout an enterprise. Reusable displays provide a graphical representation via faceplates of the field instrument connected to the HART input module.
Asset management software	FactoryTalk AssetCentre software and FieldCare software are asset management options for configuring and managing the intelligent field devices in your plant. The software packages provide these benefits: • Support Ethernet, HART, and PROFIBUS networks. • Support Endress+Hauser field instruments. • Integrate third-party devices, such as actuators, I/O systems, and sensors that support the Field Device Tool (FDT) standard. • Provide full functionality for all devices with Device Type Managers (DTMs). • Offer generic profile operation for any third-party fieldbus device that does not have a vendor DTM.

HART Handheld Device (optional)

The Field Xpert handheld device is an industrial personal digital assistant (PDA) with integrated 3.5" touch screen based on Windows Mobile. The PDA meets the needs and requirements of the process industry with protection from static electricity, water, and dust with shockproof housing. It is available in different versions for operation both inside and outside of explosion hazardous areas.

System Details

These components and specifications are recommended for preferred integration.

Hardware Components

Component	Cat. No.
HART device	See appropriate appendix
ControlLogix controller	1756-L7 controllers
CompactLogix controller	5370 CompactLogix L1, 5370 CompactLogix L2, 5370 CompactLogix L3
HART input module (Select the one that applies to your application requirements)	1756-IF8H
	1756-IF8IH
	1756-IF16H
	1794-IF8H
	1769sc-IF4IH
	1734sc-IE2CH
	1734sc-IE4CH
HART output modules (Select the one that applies to your application requirements)	1756-OF8H
	1756-OF8IH
	1769sc-OF4IH
	1734sc-OE2CIH
	1794-OE8H
	1794-OF8IH
	1797-OE8H

Software Components

Component	Cat. No.
RSLogix 5000 Enterprise Series programming software, Professional edition Includes: • RSLinx® Classic software • RSLinx Enterprise software	9324-RLD700NXENE
FactoryTalk View Site Edition (SE) software	9701-VWSXXXXXENE
FactoryTalk AssetCentre software	9515-ASTCAPXXXXX
FieldCare Standard Asset Management software, includes DTM library (optional)	SFE551
RSLinx Communication DTM software (optional)	1756-Backplane

For specifications of the Engineering Workstation (EWS) and Operator Workstation (OWS), see the PlantPAx Process Automation System Reference Manual, publication PROCES-RM001.

Performance Considerations

Keep in mind these considerations when integrating HART instruments:

- The HART communication protocol has a relatively slow communication rate at 1200/2400 bits per second.
- The 1756-IF8H and 1756-OF8H modules execute one HART command per instrument at a time. Analog (4...20 mA) data is delivered from all channels simultaneously.
- The time of execution for Universal Command 3 is estimated from 200...600 ms, but varies based on the complexity and response time of the instrument.
- Upload and download time of instrument parameters to and from FieldCare software can take several minutes depending on the instrument.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Control System Components	
ControlLogix Controllers User Manual, publication 1756-UM001	How to install, configure, operate, and maintain a ControlLogix controller.
ControlLogix Analog HART I/O Modules User Manual, publication 1756-UM533	How to install, configure, operate, and maintain a 1756-IF8H input module.
Accessing HART Device Parameters using CIP Messages, Knowledgebase document (Login required. Please contact your sales representative.)	How to use MSG instructions in controller logic to access instrument parameters.
Operator Components	
Add-On Instructions and Faceplates for Visualizing HART Instrument Data in FactoryTalk View SE, Knowledgebase document (Login required. Please contact your sales representative.)	How to implement the HART Add-On Instruction in controller logic to work with the FactoryTalk View faceplates for HART instruments.
FactoryTalk View Site Edition User's Guide Volume 1, publication VIEWSE-UM004	How to design, develop, and deploy FactoryTalk View SE applications.
FactoryTalk View Site Edition User's Guide Volume 2, publication VIEWSE-UM005	
Faceplates, Add-On Instructions, project files, etc. (Login required. Please contact your sales representative.)	Download Add-On Instructions, faceplates, and global object graphics, and project files.
http://www.products.endress.com/fieldcare	Information about FieldCare Asset Management software.
http://www.products.endress.com/dtm-download	Information about field instrument DTMs.
Process Control Information	
PlantPAx Process Automation System Selection Guide, publication PROCES-SG001.	Provides basic definitions of system elements and sizing guidelines for procuring a PlantPAx system.
PlantPAx Process Automation System Reference Manual, publication PROCES-RM001	Process system recommendations that organize Rockwell Automation products functionally as system elements, which can then be applied in proven, scalable configurations for continuous and batch control.
http://www.rockwellautomation.com/process	Information about Rockwell Automation process control and Integration Documents.
http://literature.rockwellautomation.com	Available Rockwell Automation publications, including Integration Documents.
http://www.endress.com	Information about Endress+Hauser field instruments.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Installation

Topic	Page
Connect a 2-Wire Field Instrument	17
Connect a 4-Wire Field Instrument	21

Connect a 2-Wire Field Instrument

HART communication is active only with current inputs. Connect a 2-wire field instrument to any channel of the HART input module in a 2-wire configuration for current input.

HART devices that support 2-wire connections include the following.

Device	See appendix
Prowirl 73 flowmeter	Appendix D on page 91
Levelflex M guided level-radar	Appendix F on page 103
Micropilot M level-radar	Appendix G on page 107
Prosonic M ultrasonic level	Appendix E on page 97
Liquiline M CM42 transmitter	Appendix M on page 139
Cerabar S pressure transmitter	Appendix H on page 111
Deltabar S differential pressure	Appendix I on page 117
iTEMP TMT162 temperature transmitter	Appendix K on page 131
iTEMP TMT182 temperature transmitter	Appendix L on page 135

Figure 1 - 2-Wire Connection to 1756-IF8H Input Module

Figure 2 - 2-Wire Connection to 1756-IF16H Input Module

Figure 3 - 2-Wire Connection to 1794-IE8H Input Module

+V = +24V dc = Terminals C-34 and C-50
-V = COM = C-35 and C-51
Chassis Ground = Terminals B-16, B-33, C-38, C-40…45, and C-47
NC = No connection
For daisy-chaining: Supply in - C-34 (+) and C-35 (-)
Supply out - C-50 (+) and C-51 (-)

(1794-TB3G shown)

Figure 4 - 2-Wire Connection to 1794-IF8IH Input Module

Figure 5 - 2-Wire Connection to 1769sc-IF4IH Input Module
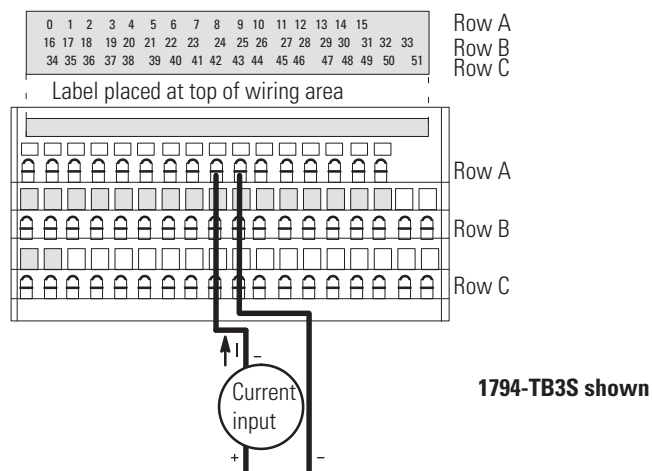
Figure 6 - 2-Wire Connection to 1734sc-IE2CH Input Module
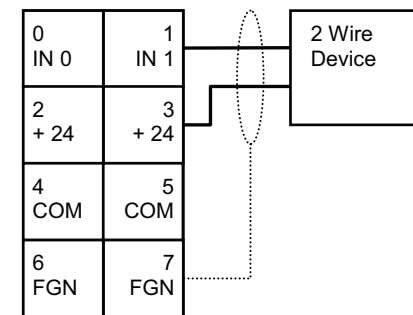
Figure 7 - 2-Wire Connection to 1734sc-IE4CH Input Module

Connect a 4-Wire Field Instrument

HART communication is active only with current inputs. Connect a 4-wire field instrument to any channel of the HART input module in a 4-wire configuration for current input.

HART devices that support 4-wire connections include the following.

Device	See appendix
Promass 83 flowmeter	Appendix A on page 77
Promag 53 flowmeter	Appendix C on page 87
Proline t-mass 65 flowmeter	Appendix B on page 83
Prosonic S transmitter	Appendix J on page 125

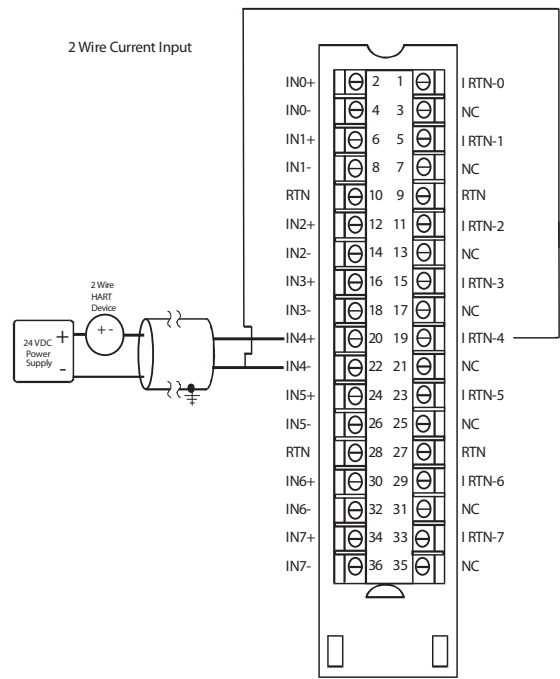**Figure 8 - 4-Wire Connection to 1756-IF8H Input Module**
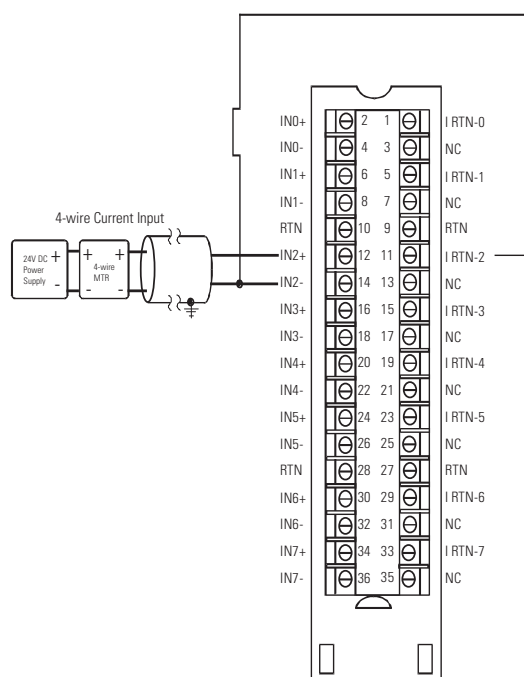
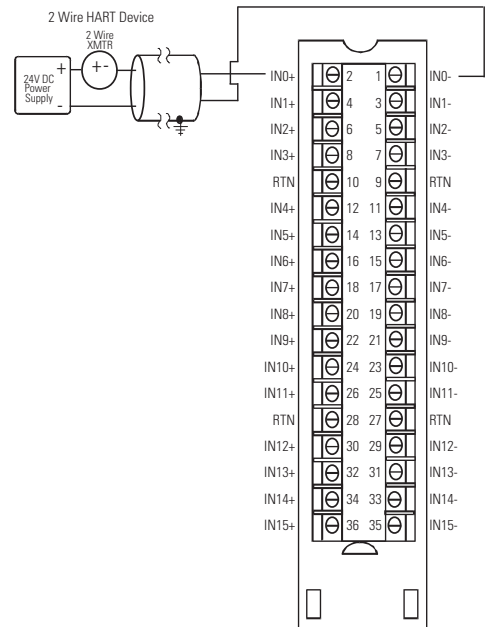**Figure 9 - 4-Wire Connection to 1756-IF16H Input Module**

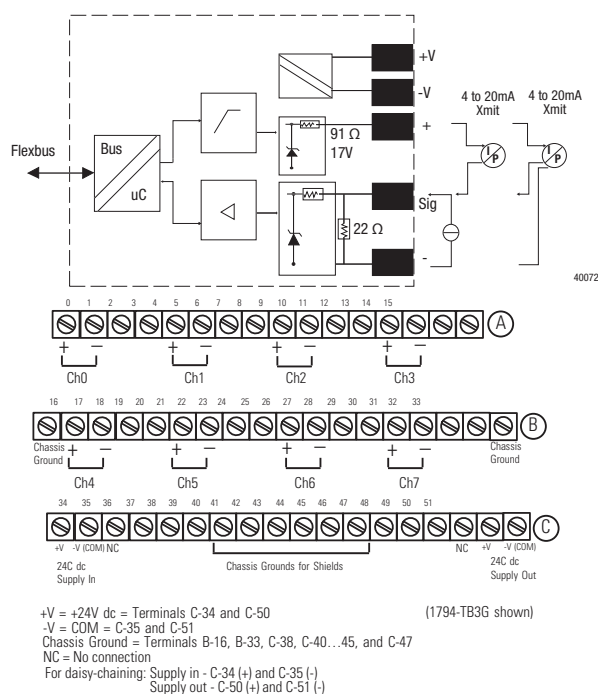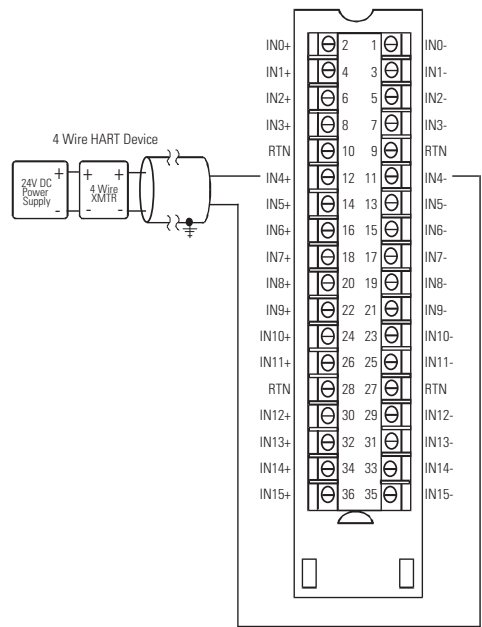**Figure 10 - 4-Wire Connection to 1794-IF8IH Input Module**
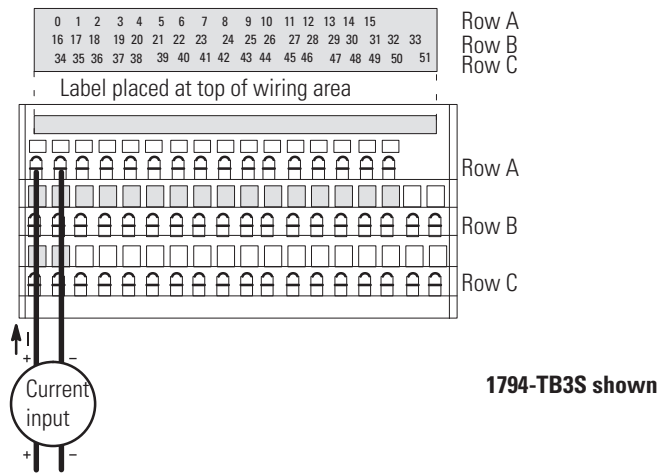
Figure 11 - 4-Wire Connection to 1769sc-IF4IH Input Module
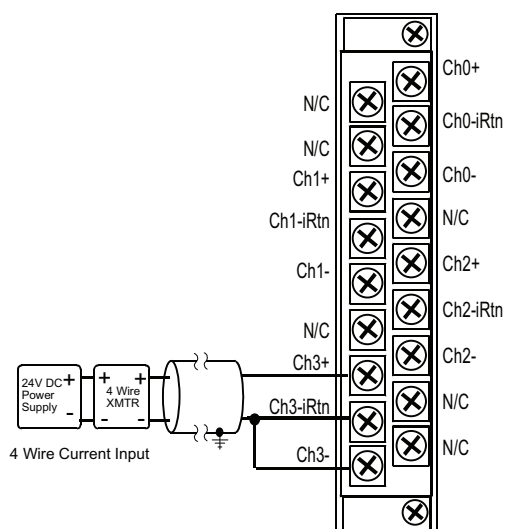
Figure 12 - 4-Wire Connection to 1734sc-IE2CH Input Module
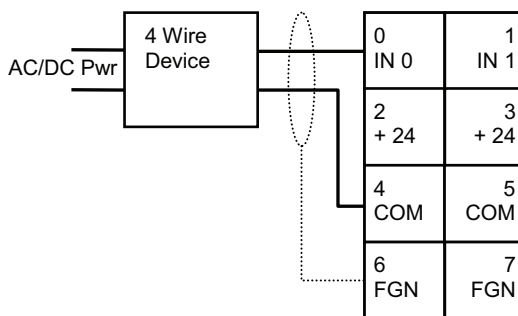
Figure 13 - 4-Wire Connection to 1734sc-IE4CH Input Module
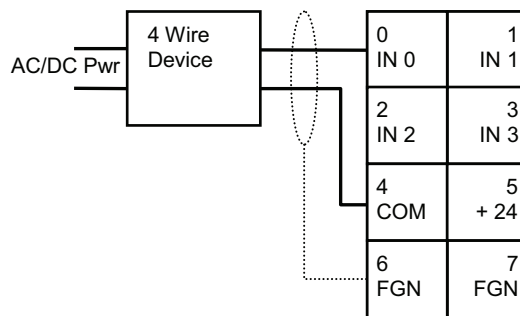
Notes:

Configure the HART Device in RSLogix 5000 Programming Software

The examples in this chapter use RSLogix 5000 programming software, version 20.

Configure a HART Input Module in a System

In RSLogix 5000 software, you must have a project open with a controller already configured. Make sure that the project path is set to the correct controller.

Use RSWho Active in RSLogix 5000 software to verify that the controller, HART input module, and devices are active.
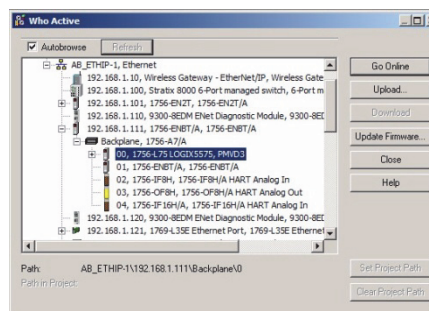
To configure the I/O module, complete these steps within the configuration tree.

1. From the configuration tree, right-click the 1756 backplane and choose New Module.
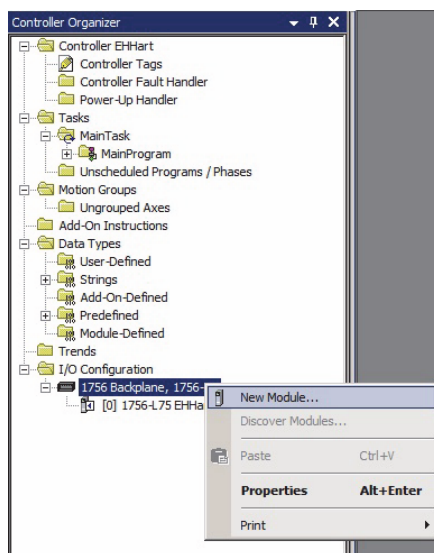
If the controller communicates with the I/O module over a network, the network interfaces must be added to the configuration tree before adding the I/O module.

2. From the list, select the 1756-IF8H input module.
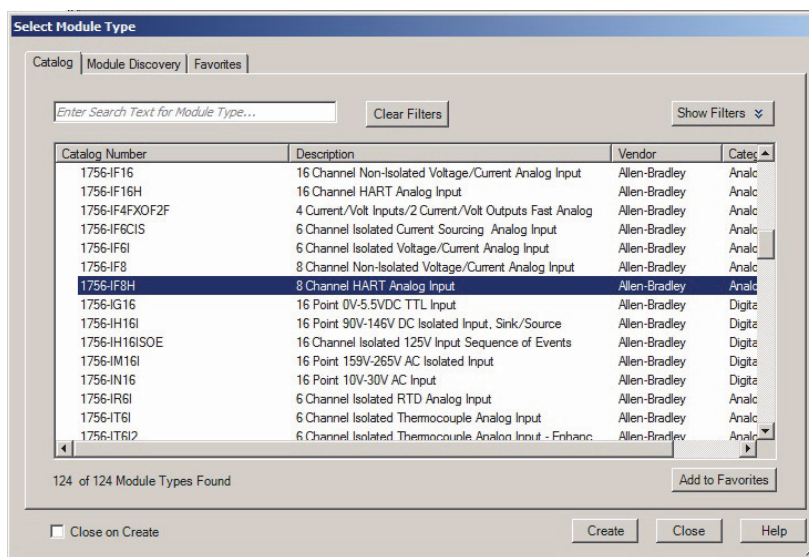
3. On the General tab, enter the configuration information for the module.
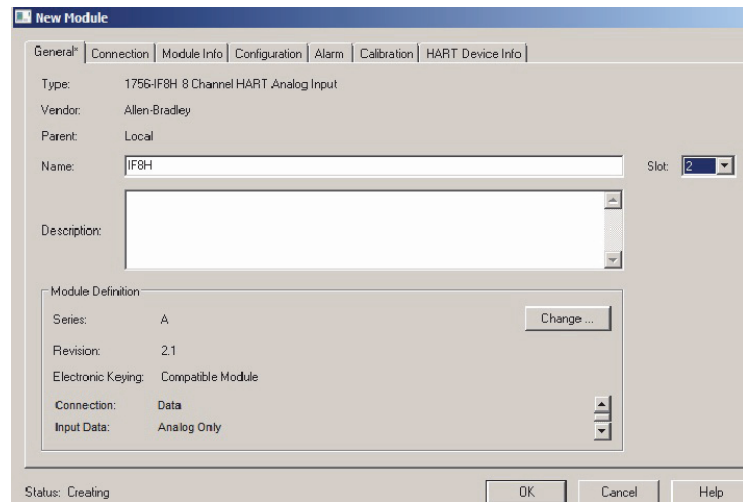
4. Click Change.
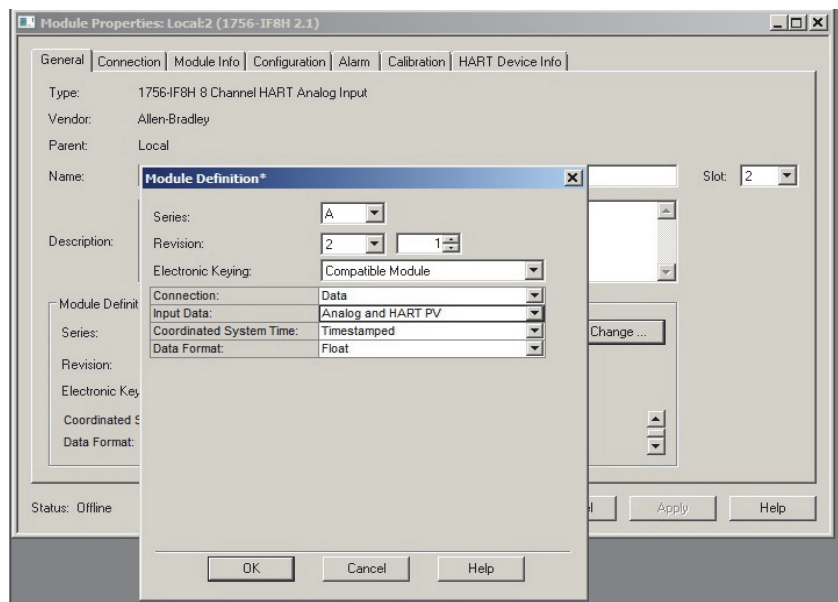
5. For Input Data, choose Analog and HART PV.

6. On the Configuration tab, enable HART for each channel connected to a device.

Each channel **must** be enabled to pass HART data to the controller.

7. On the Configuration tab, for Passthrough, choose Once per channel scan.
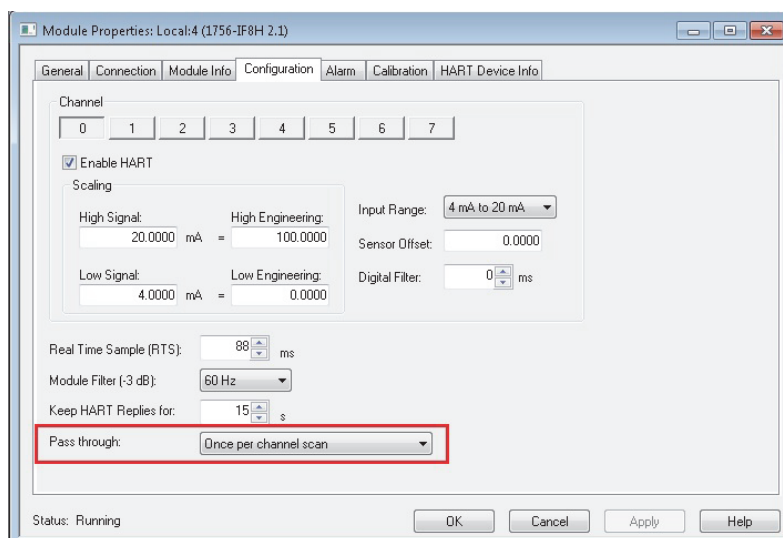
This passthrough selection is the fastest and best for asset management software.

8. When complete, click OK.

9. Click Download to go online.
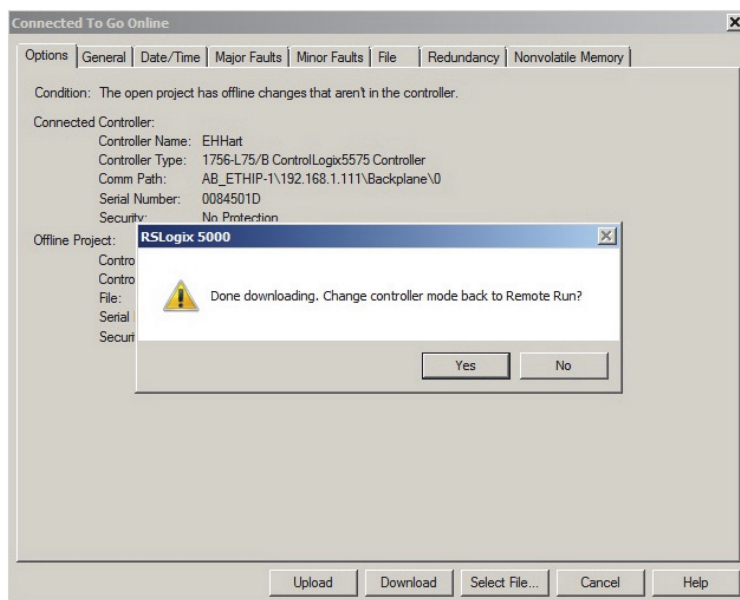
10. From the HART Device Info tab in the HART module properties, verify that the instrument is connected.
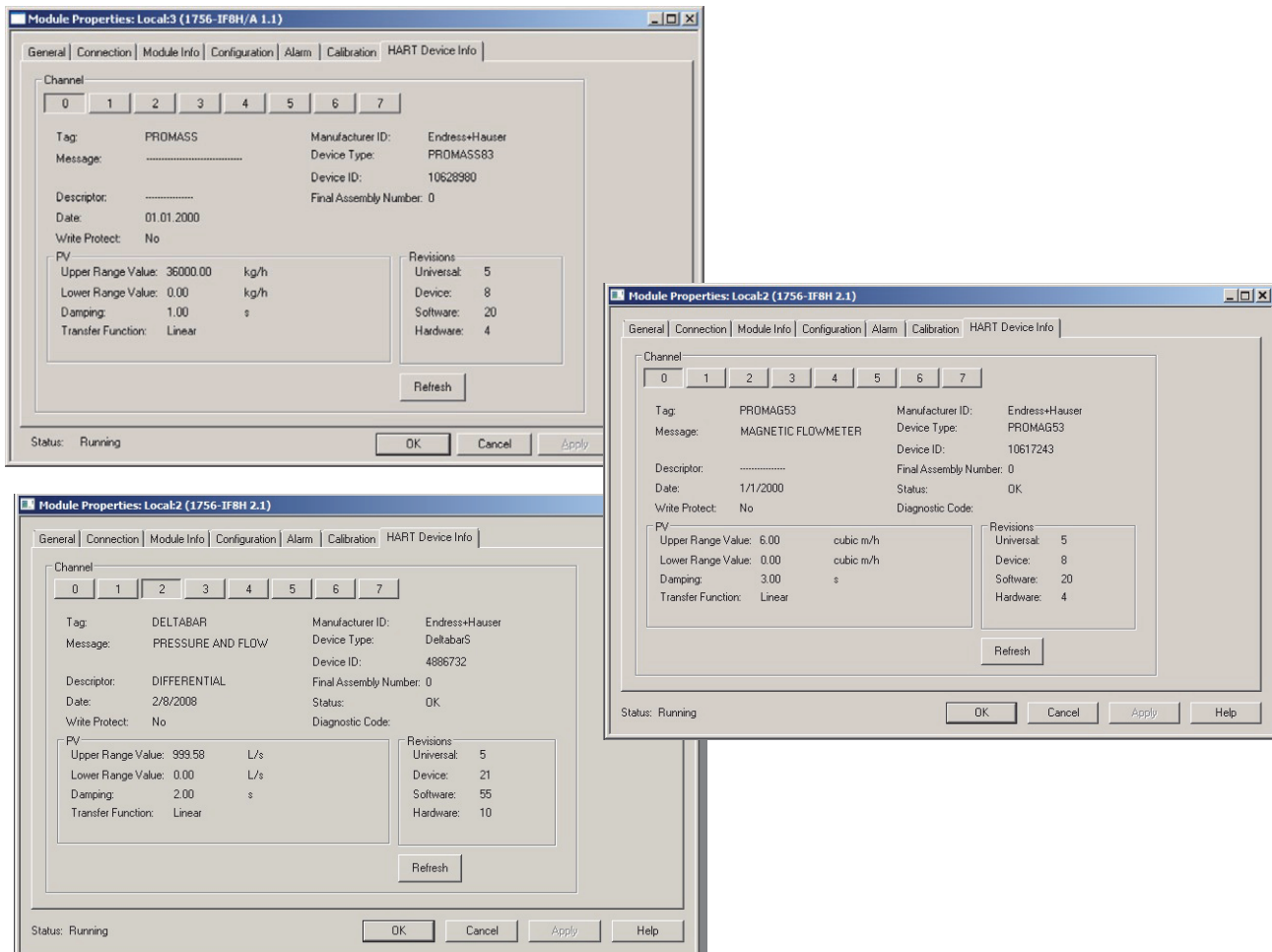
11. Check Controller Tags to verify that the HART instrument is connected and passing data.
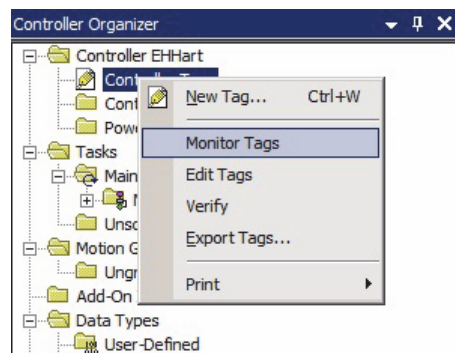
A connected instrument displays values in the PV, SV, TV, and FV fields. This tag example shows that the HART input module is in slot 6.
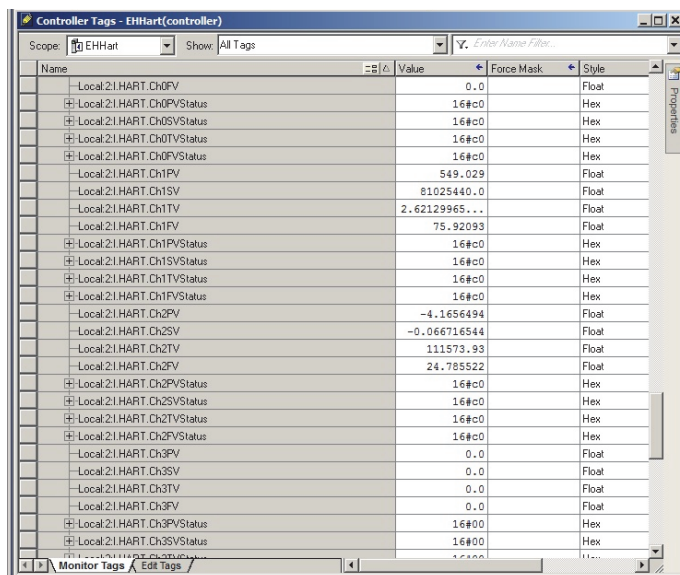
If HART data is not present, make sure that the HART function is enabled.
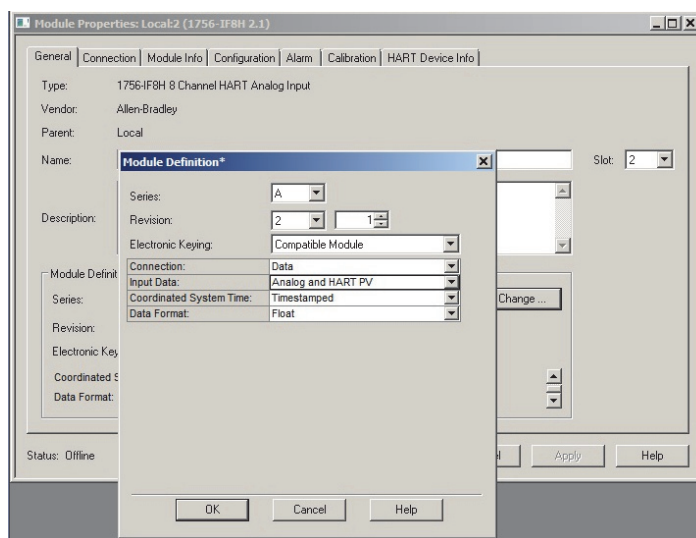
Configure an IF8IH Module

To configure a 1756-IF8IH isolated analog input module, follow the same procedures as described for the 1756-IF8H input module. In step 2, select the 1756-IF8IH module.

The 8-channel isolated input analog module provides additional field device information from two tabs on the Module Properties dialog box: HART Command and HART Device Info.

The HART Command tab lets you specify HART device parameters for each channel, notably PV damping and range. These values are sent to the HART device.
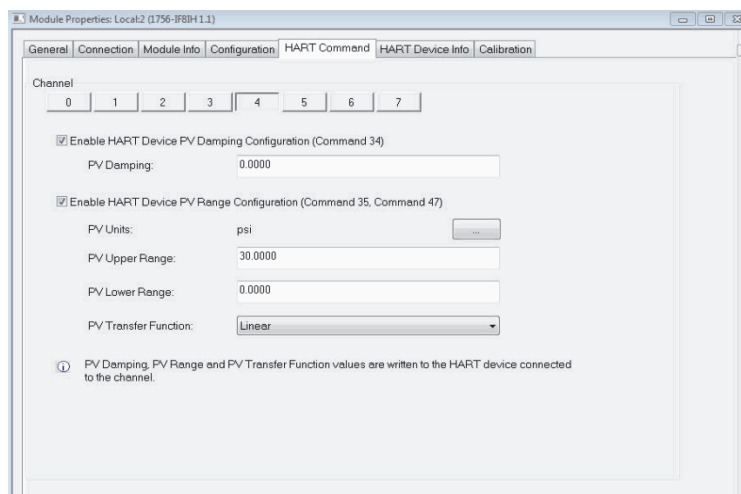
The HART Device Info tab displays information about the field device and provides a button to configure device Tag, Message, and Descriptor.
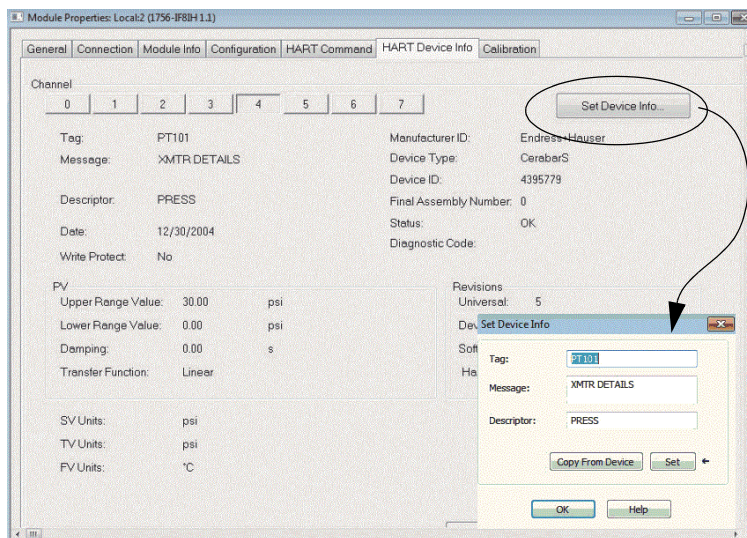
For more information, see the HART Analog I/O Modules User Manual, publication 1756-UM533.

Configure a HART Input Module in a Compact I/O System

Use RSWho Active in RSLogix 5000 software to verify that the controller, HART input module, and devices are active.

This example has a 1769-L35E CompactLogix controller and the Spectrum 1769sc-IF4IH module and uses the Spectrum sample ACD file.
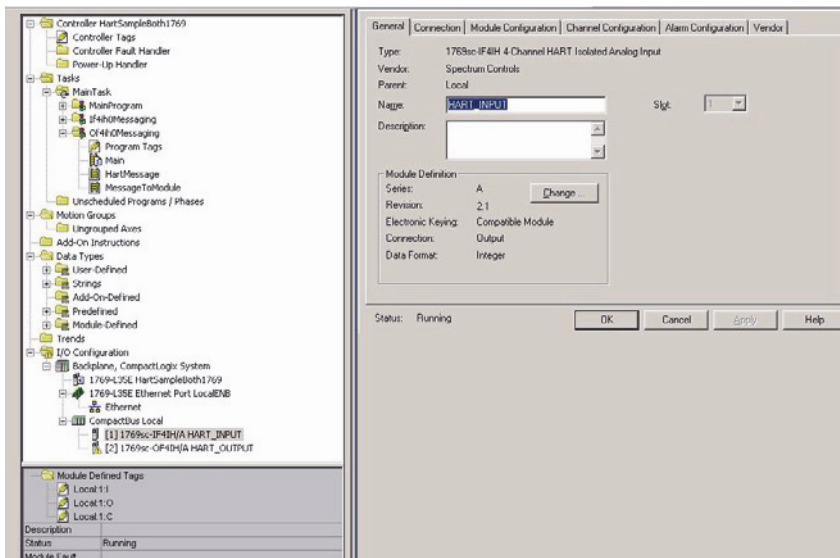
The Spectrum 1769sc-IF4IH is configured as shown.
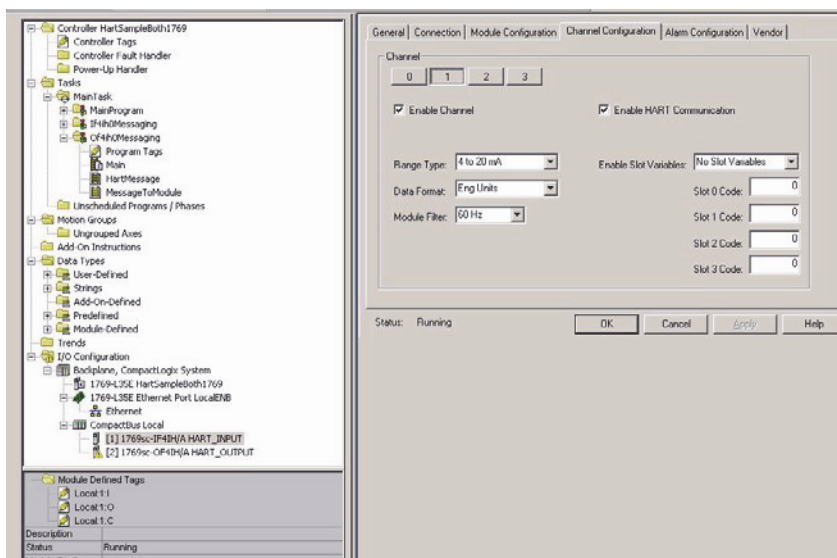
Make sure that Enable Channel and Enable HART Communication are both checked.

The Spectrum 1769sc-IF4IH has these controller tags.

This example shows the PV values from the device that are mapped to the data structure.

## Configure a HART Input Module in a FLEX I/O System

In RSLogix 5000 software, you must have a project open with a controller already configured. Make sure that the project path is set to the correct controller.

Use RSWHO Active in RSLogix 5000 software to verify that the controller, HART input module, and devices are active.

To configure the I/O module, complete these steps within the configuration tree. This example assumes that you have a 1756-ENBT interface and a 1794-AENT adapter.

1. From the configuration tree, right-click FlexBus under the 1794-AENT adapter and choose New Module.

2. From the list, select the HART input module and click Create.
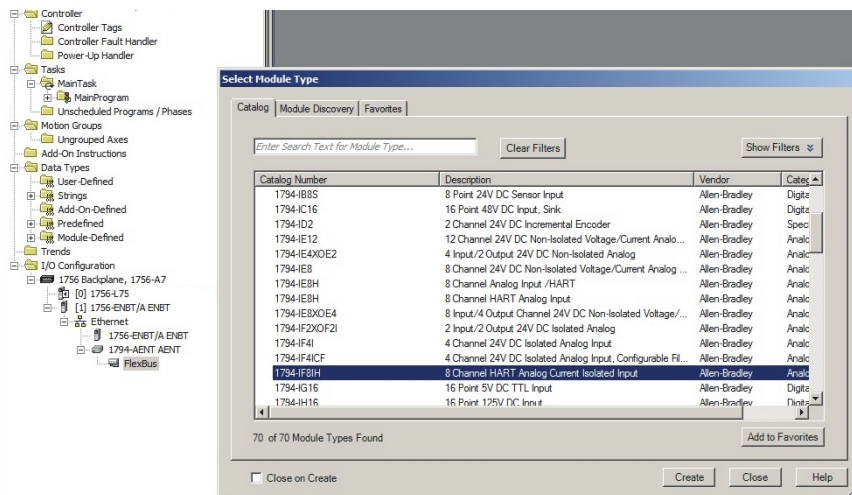
3. Enter the configuration information for the module and choose the HART communication format.
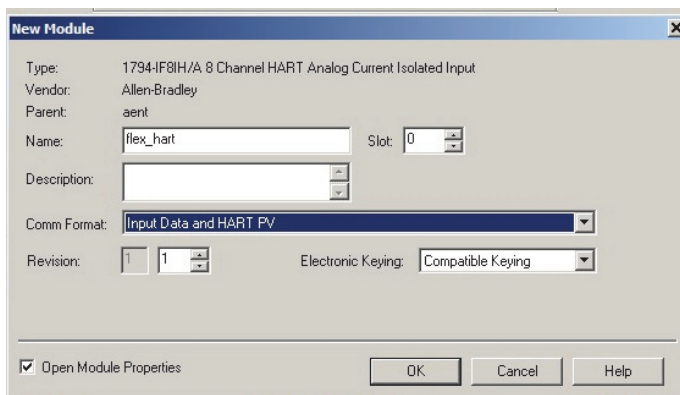
4. Click OK.

5. Go online and check the controller tags to make sure that the device is connected.

Name		Value	Force Mask	Style
⊟ aent:0:I2		{...}	{...}	
⊞ aent:0:I2.Fault		2#0000_000...		Binary
aent:0:I2.Ch0HARTCmd3Status		0		Decimal
aent:0:I2.Ch1HARTCmd3Status		0		Decimal
aent:0:I2.Ch2HARTCmd3Status		0		Decimal
aent:0:I2.Ch3HARTCmd3Status		0		Decimal
aent:0:I2.Ch4HARTCmd3Status		0		Decimal
aent:0:I2.Ch5HARTCmd3Status		0		Decimal
aent:0:I2.Ch6HARTCmd3Status		0		Decimal
aent:0:I2.Ch7HARTCmd3Status		0		Decimal
⊟ aent:0:I2.Ch0HART		{...}	{...}	
⊞ aent:0:I2.Ch0HART.CommunicationStatus		2#0000_0000		Binary
⊞ aent:0:I2.Ch0HART.FieldDeviceStatus		2#0000_0000		Binary
⊞ aent:0:I2.Ch0HART.LoopStatus		2#0010_1011		Binary
aent:0:I2.Ch0HART.PVAcquired		1		Decimal
aent:0:I2.Ch0HART.SVAcquired		1		Decimal
aent:0:I2.Ch0HART.TVAcquired		1		Decimal
aent:0:I2.Ch0HART.FVAcquired		1		Decimal
aent:0:I2.Ch0HART.PV		91.66205		Float
aent:0:I2.Ch0HART.SV		76.28302		Float
aent:0:I2.Ch0HART.TV		1.#QNAN		Float
aent:0:I2.Ch0HART.FV		1.#QNAN		Float
⊞ aent:0:I2.Ch0HART.PVUnitsCode		2#0011_1001		Binary
⊞ aent:0:I2.Ch0HART.SVUnitsCode		2#0010_0001		Binary
⊞ aent:0:I2.Ch0HART.TVUnitsCode		2#1111_1010		Binary
⊞ aent:0:I2.Ch0HART.FVUnitsCode		2#1111_1010		Binary
⊞ aent:0:I2.Ch1HART		{...}	{...}	

Configure a HART Input Module in a POINT I/O System

In RSLogix 5000 software, you must have a project open with a controller already configured. Make sure that the project path is set to the correct controller.

Use RSWHO Active in RSLogix 5000 software to verify that the controller, HART input module, and devices are active.
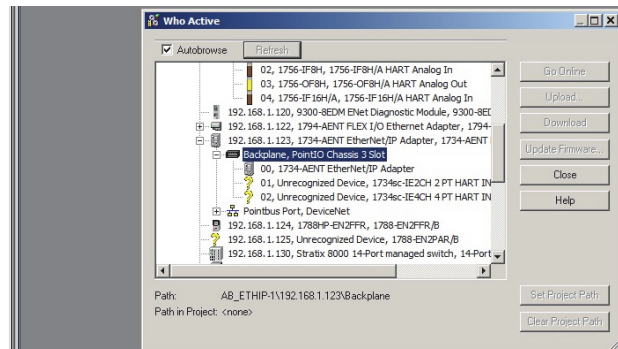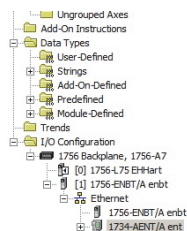
To configure the I/O module, complete these steps within the configuration tree. This example assumes that you have a 1756-ENBT interface and a 1734-AENT adapter.

1. From the configuration tree, right-click the POINTIO chassis under the 1734-AENT module and choose New Module.
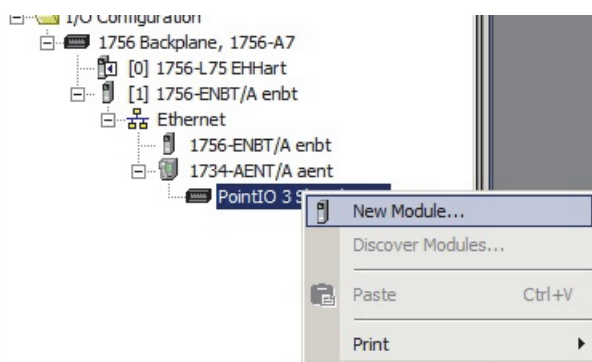
2. From the list, select the HART input module and click Create.
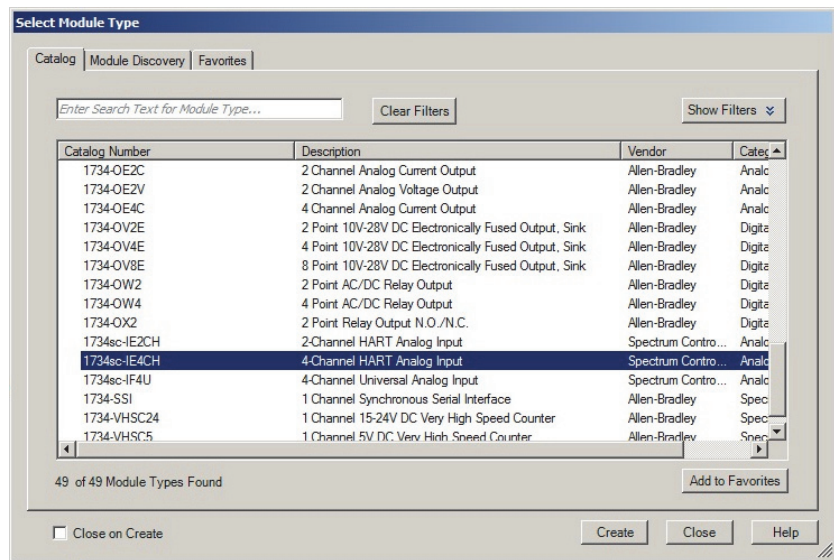
3. Enter the configuration information for the module and click Change.
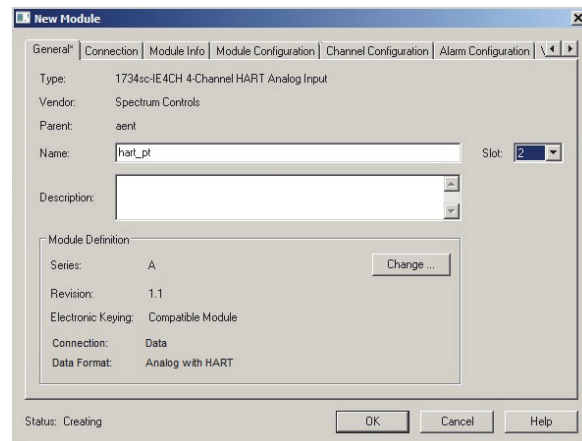
4. Enter additional configuration information and click OK.
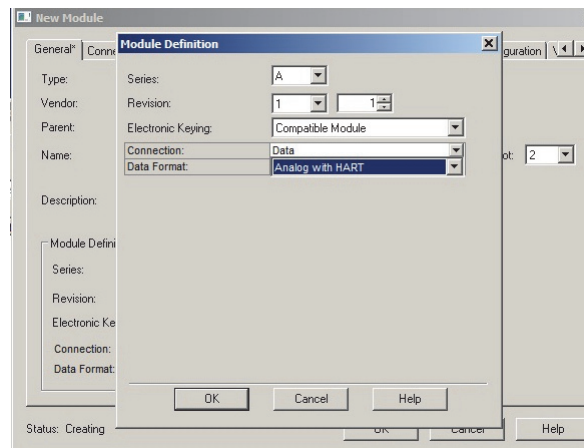
5. From the Channel Configuration tab, choose the channel.

6. Enable the HART function for each channel required.
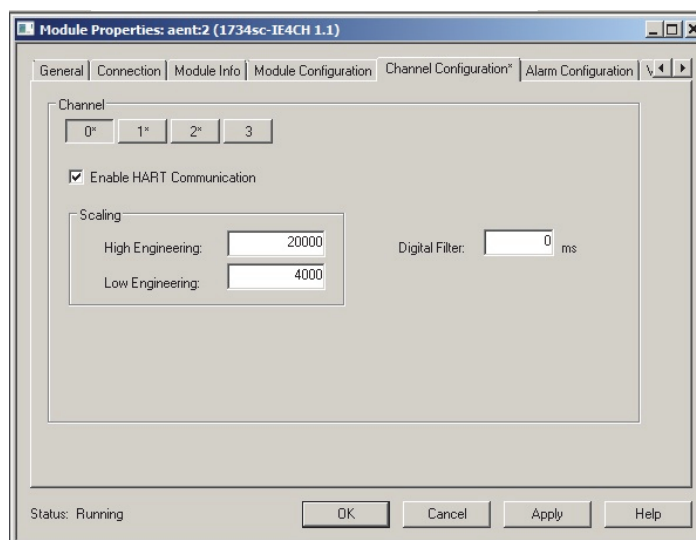
7. Click OK.

8. Go Online and check the controller tags to verify operation.
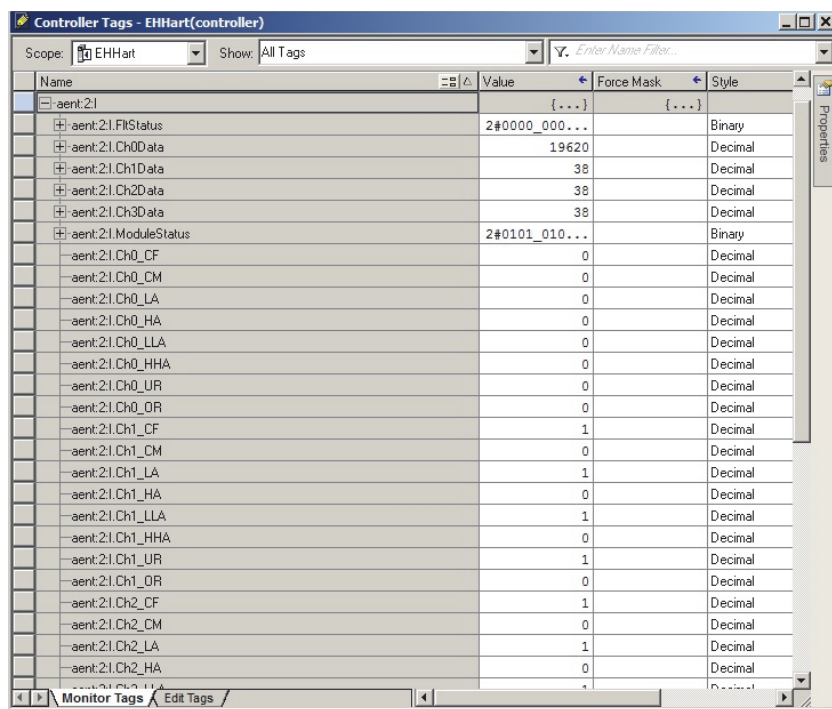
Configure the HART Device in FactoryTalk AssetCentre Software

Topic	Page
Update the DTM Catalog	39
Configure the DTM Network Path	40
Configure a HART Device	48
Configure a FLEX I/O Module	54

FactoryTalk AssetCentre software is a FDT-based, plant asset management software tool that you use to configure intelligent field instruments for Endress+Hauser.

IMPORTANT	Before beginning this process, make sure the DTM and Electronic Data Sheet (EDS) files have been downloaded from the vendor websites, imported, and installed.

Update the DTM Catalog

Complete these steps to update the DTM catalog.

1. Launch AssetCentre software and open a project.

2. Choose Tools > DTM catalog to update the available DTMs.
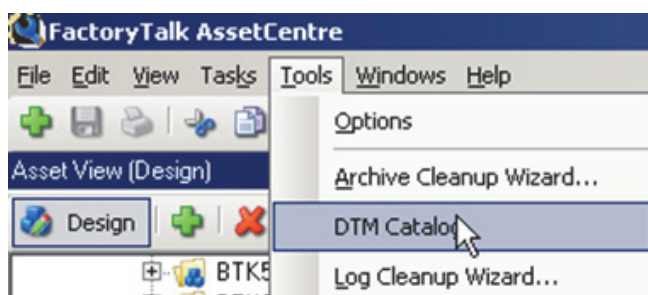
3. Look through the catalog of installed DTMs and look for a green check mark on the appropriate DTM.

A yellow triangle indicates that the DTM is found but needs to be scanned.
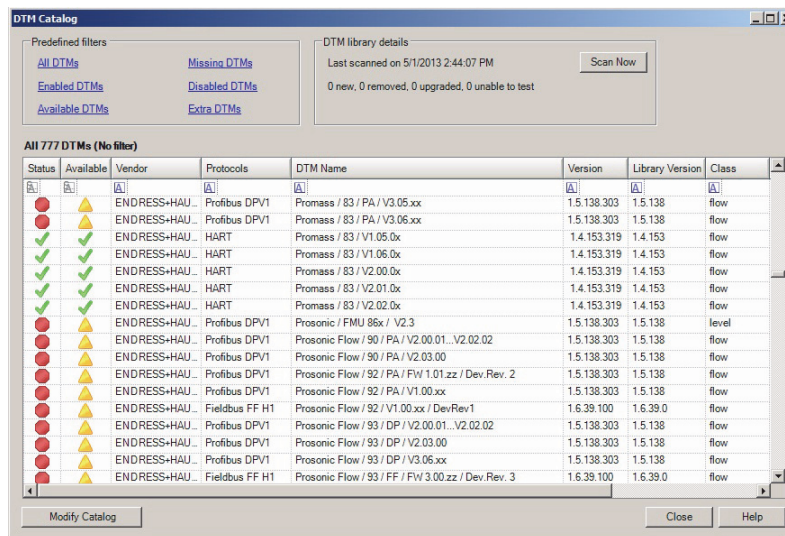
4. If necessary, click Scan Now and then verify the DTMs that you installed exist in the catalog.

5. Close the DTM catalog.

Configure the DTM Network Path

The network path varies based on your system. In this example, the host personal computer communicates through a 1756 backplane.

1. Choose Tasks > DTM Networks.
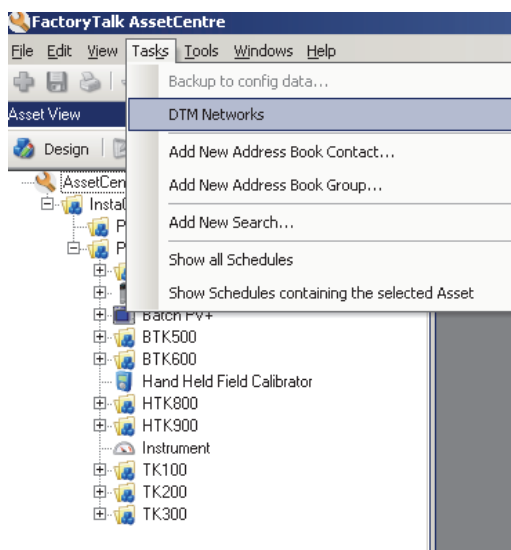
2. Click the name of the Host PC network and then click Add DTM.
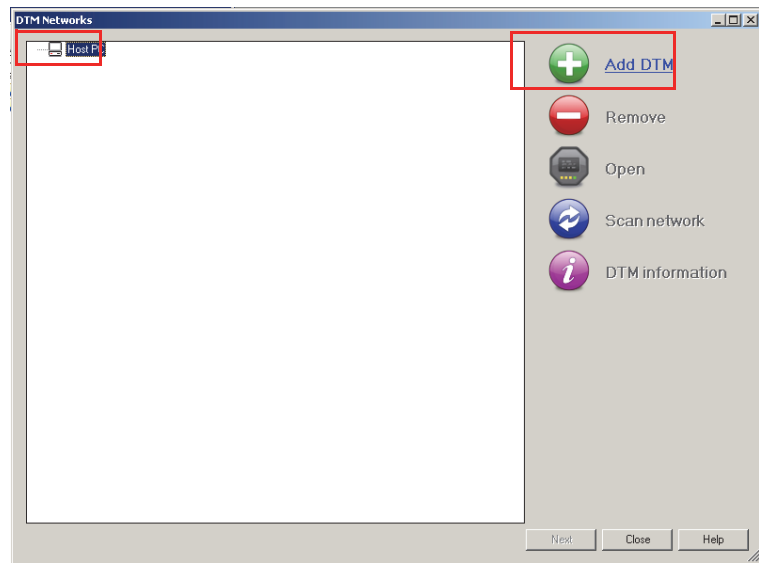
3. Click the 1756 Chassis DTM.
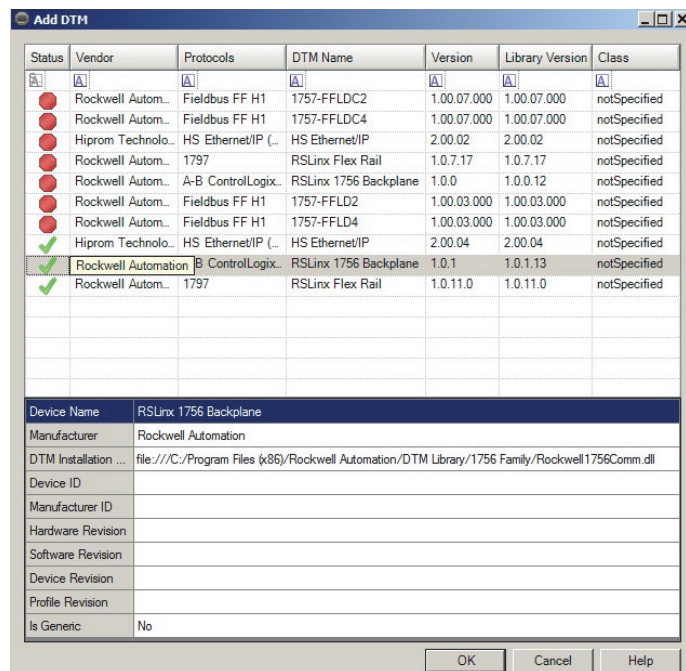
The tree appears as shown in the example.
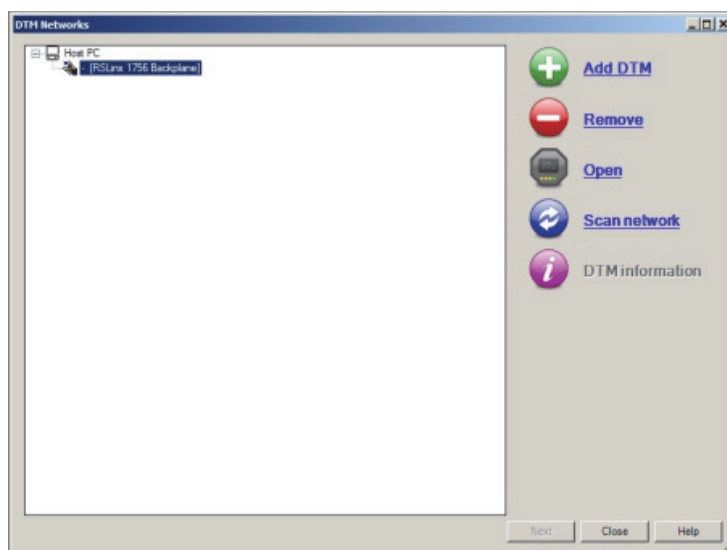
4. Select the chassis and click Add DTM

The DTM Networks dialog box appears.
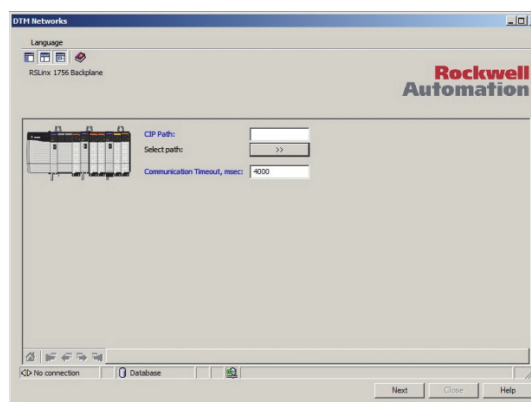
5. Browse to the backplane containing the appropriate controller and click OK.

6. Click Select path to autobrowse.

Some I/O modules require that you click Open to configure the path.
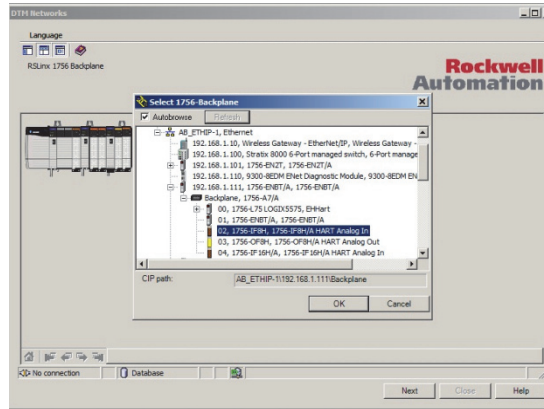
7. Click Next.
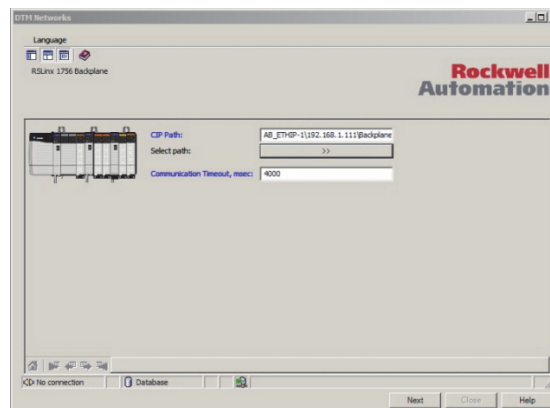
8. Select DTM Networks and view the tree.

9. Select the chassis and click Add DTM.
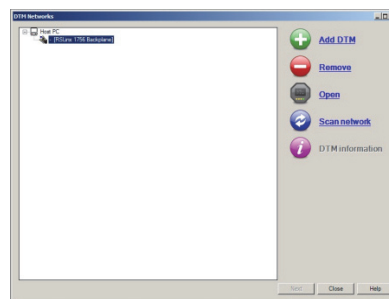
10. Select the I/O module.
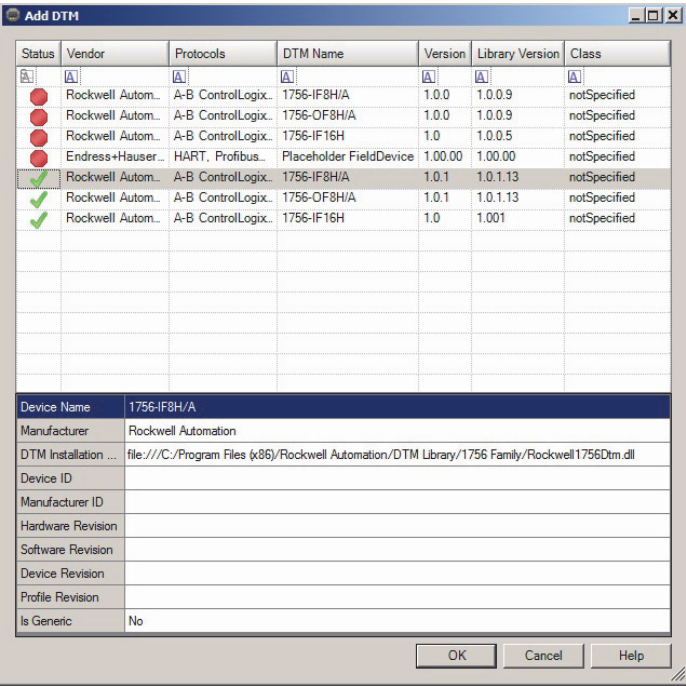
11. Click OK.

12. Enter the slot number and other configuration data.
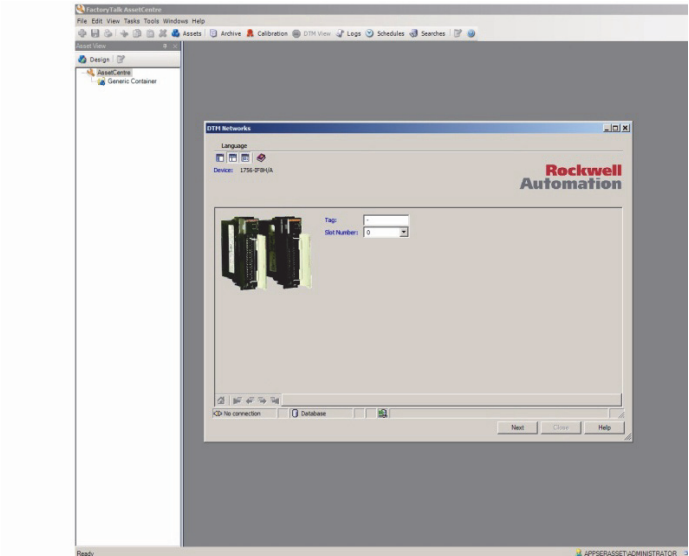
13. Click Next.
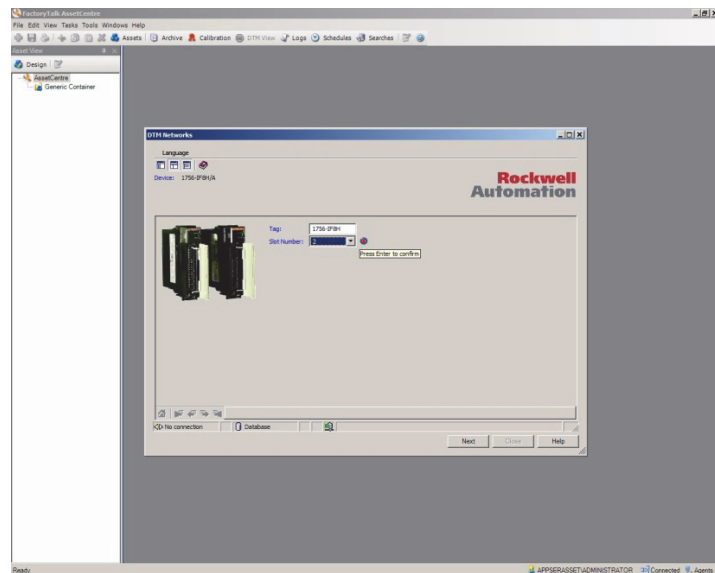
14. Select the module and click Add DTM.
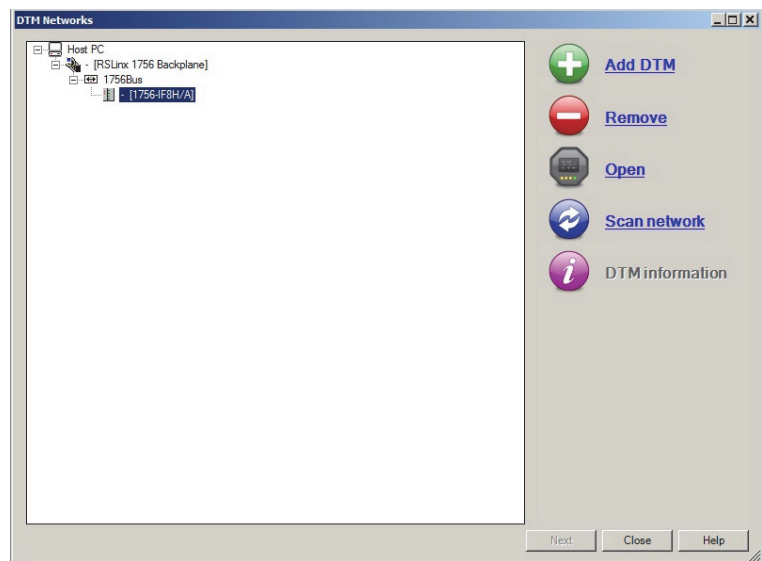
15. Select the correct channel and click OK.

Repeat for additional channels with devices.
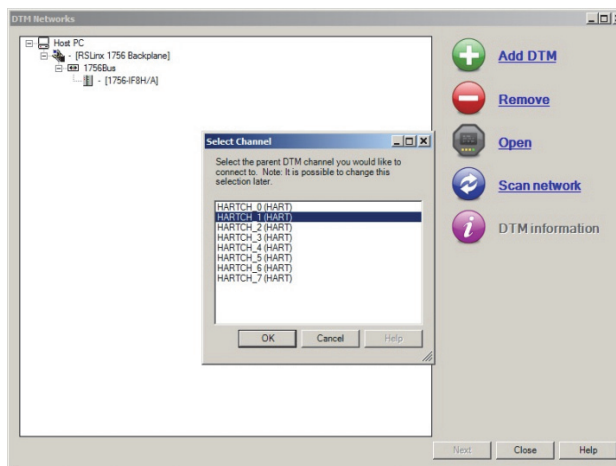
16. Click Scan network to locate devices.
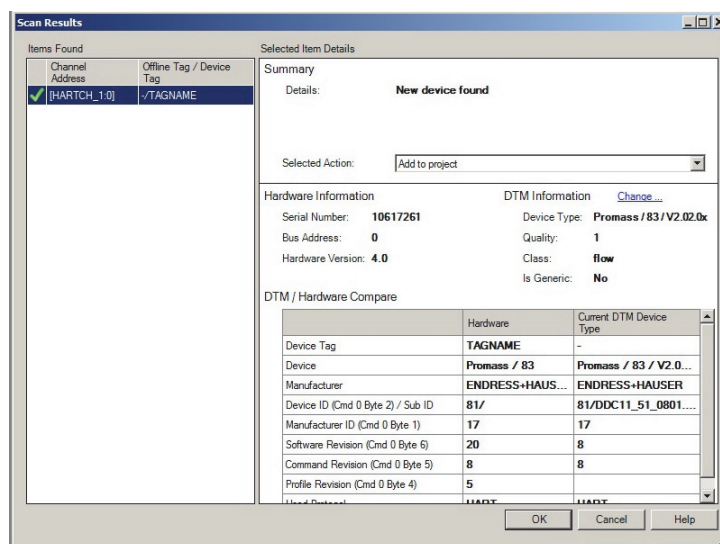
17. Click OK.

18. Click DTM information.
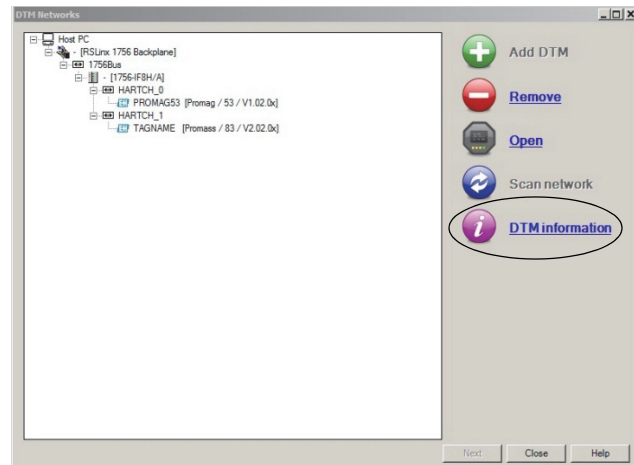
19. Make sure the correct DTMs are available and green.

Scan for any required DTMS that appear in yellow.
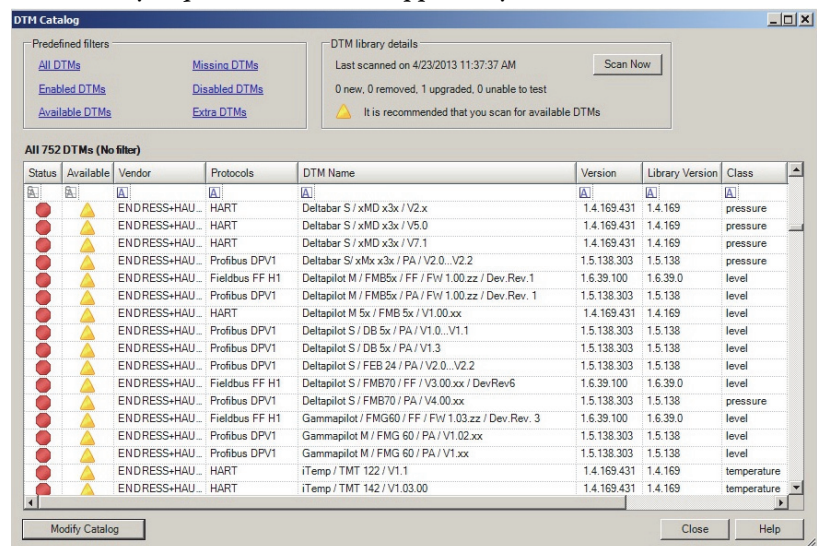
Configure a HART Device

Complete these steps to configure a HART device.

1. Right-click the device and choose Online.
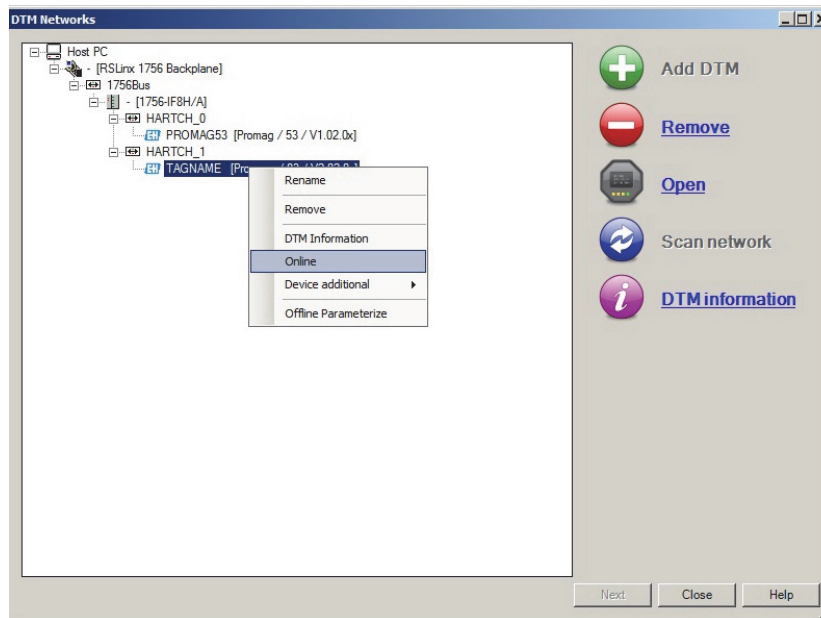
2. Click Open.

   The DTM Networks dialog box appears with device information.
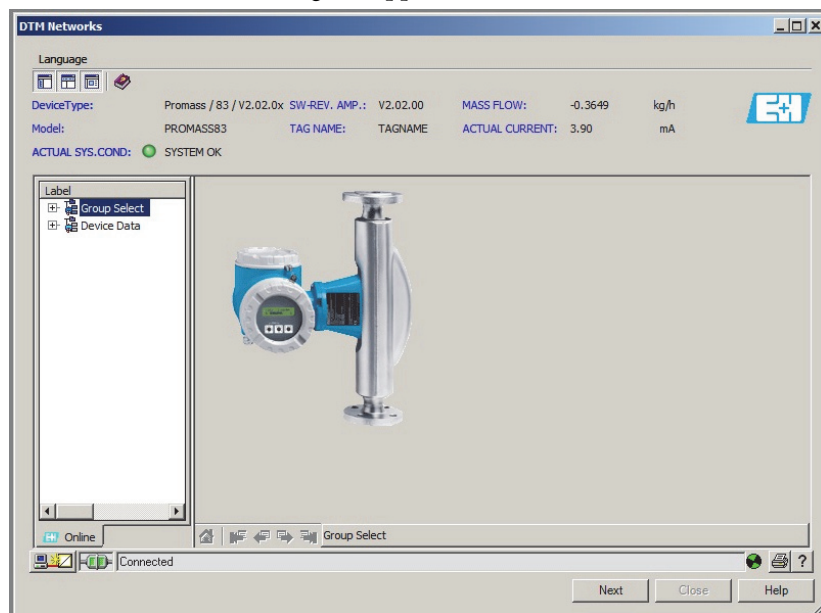
3. Click Next.
4. Click Design.

5. Choose Process Area > New.
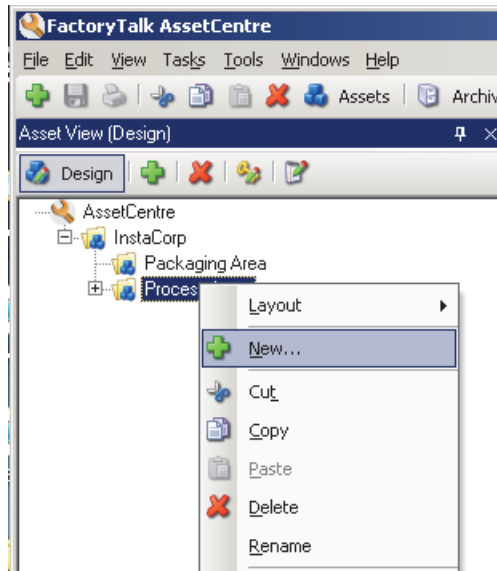
6. In the Process Area tree, choose Instrument.
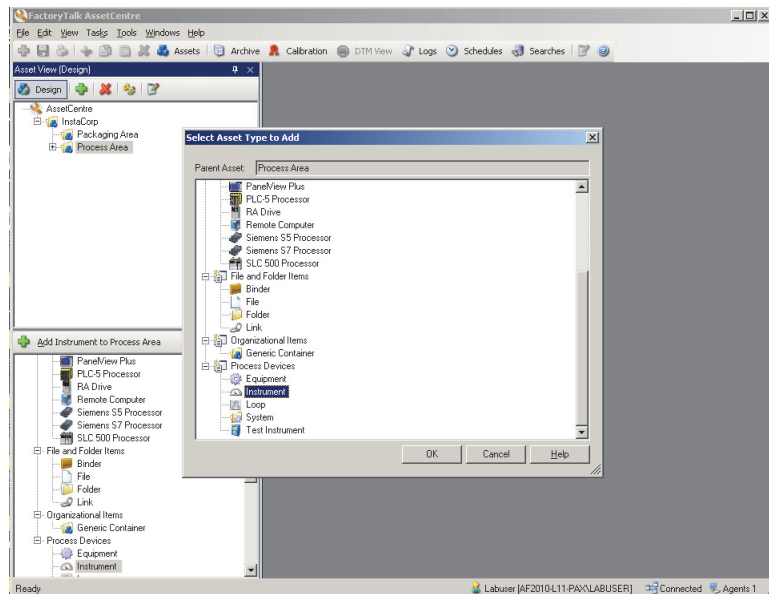
7. Type the name of the device and click OK.
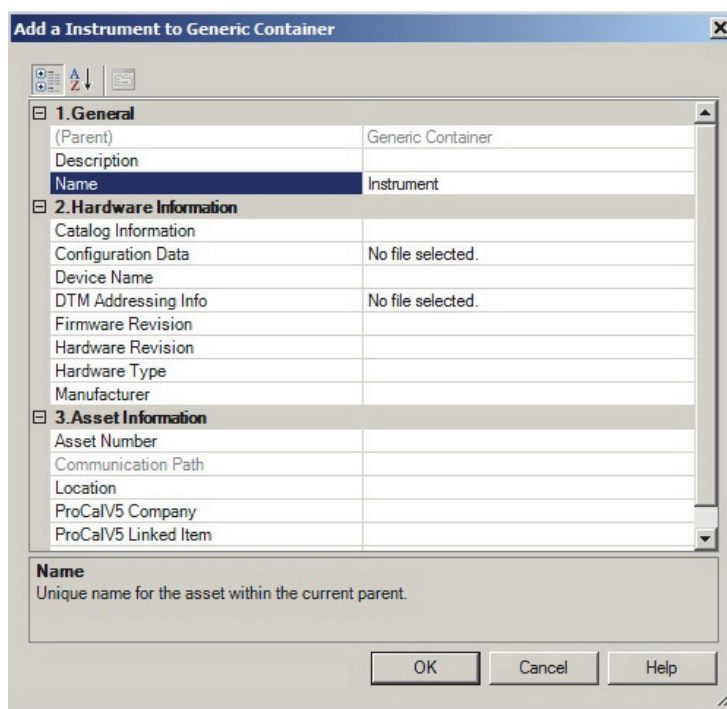
8. Right-click the name of the device you just created, and choose Properties.
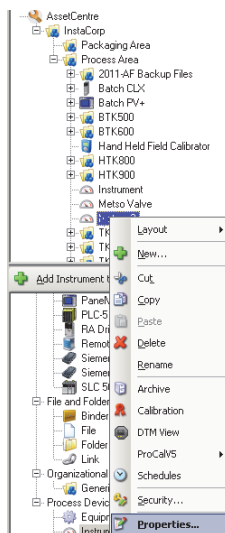
9. Select DTM Addressing Info and click the ellipsis.
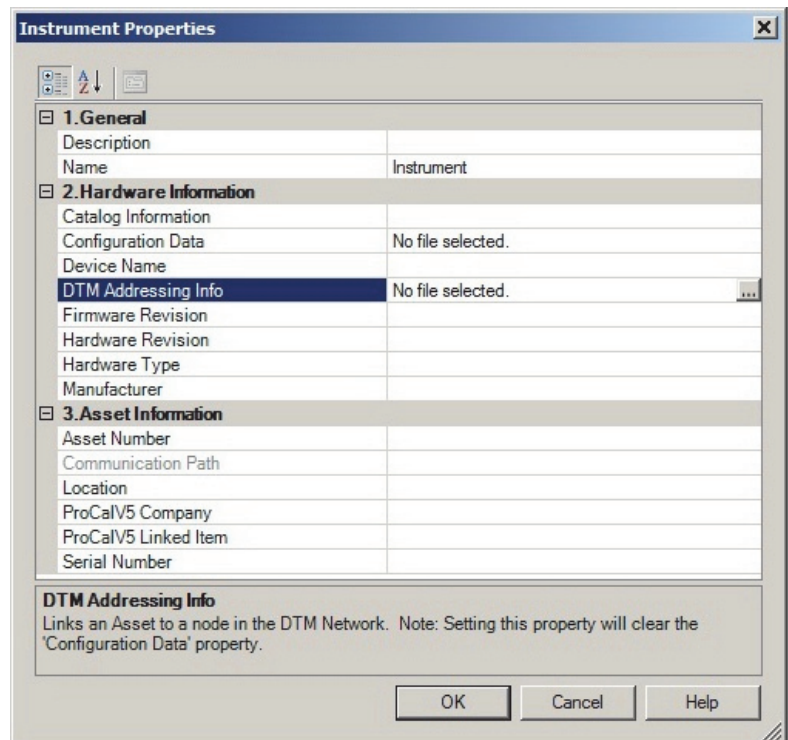
10. Select the device and click OK.
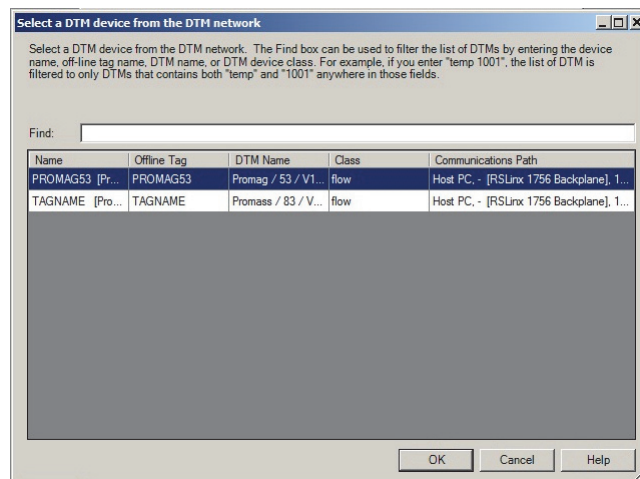
The device information appears.

11. Click OK.
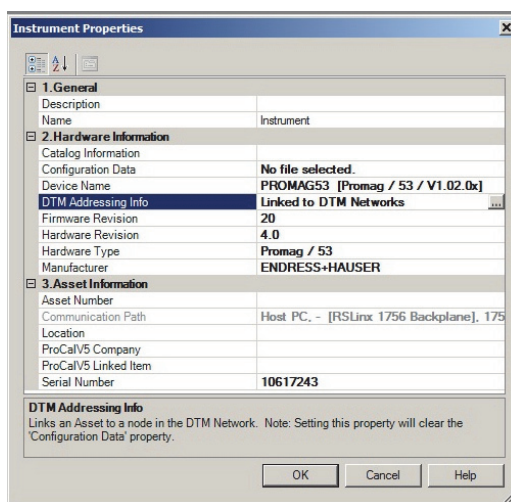
12. Right-click the device name and choose DTM View.
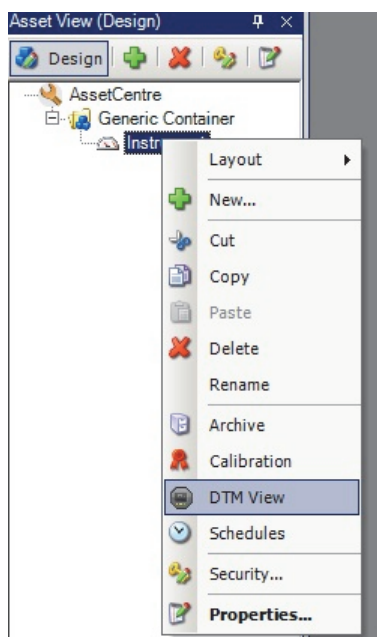
13. When the device information appears, go online.
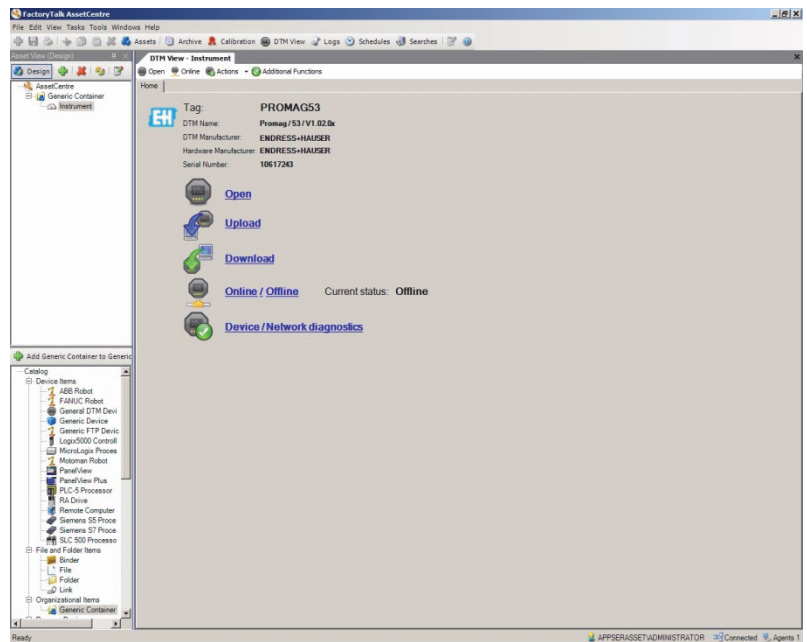
14. Select any views that are desired and save the project.
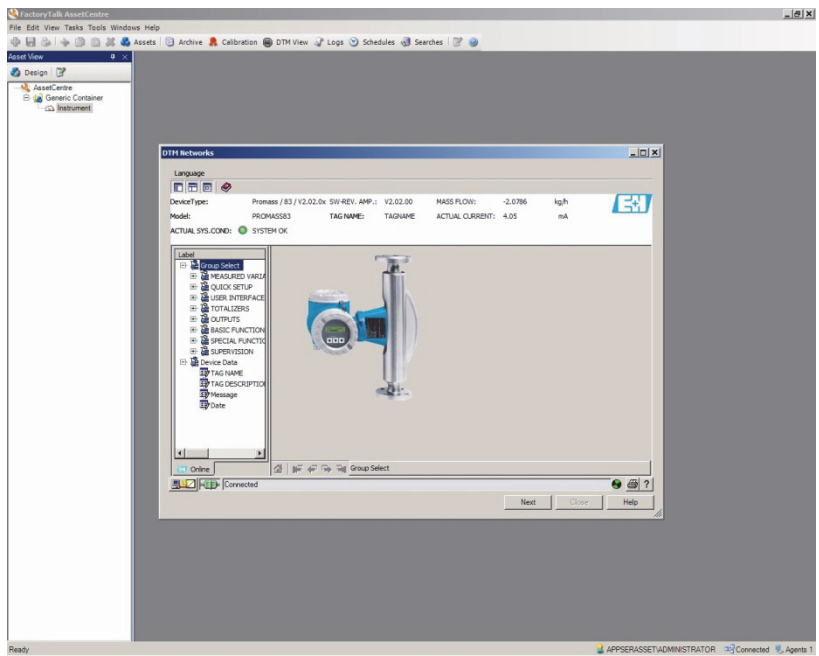
Configure a FLEX I/O Module

Complete these steps to configure a FLEX I/O module.

1. From the DTM Networks tree, select the FLEX rail.

2. Click Add DTM.
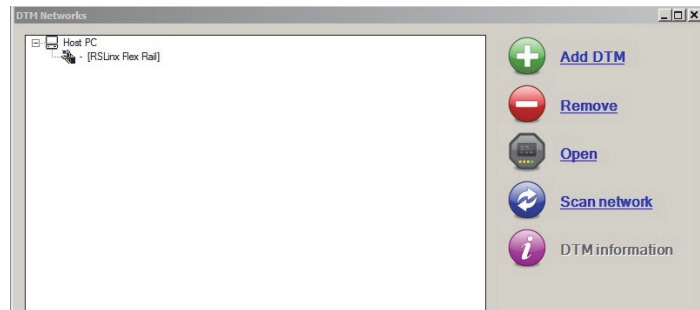
3. Select the FLEX I/O module and click OK.
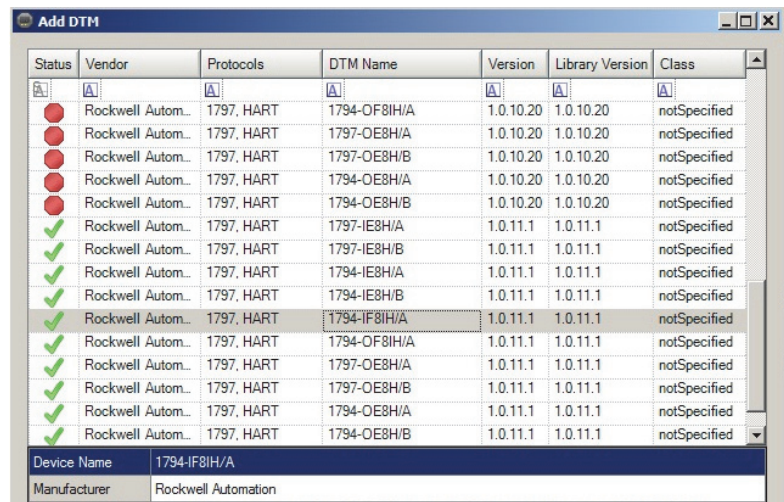
The tree looks like the example.
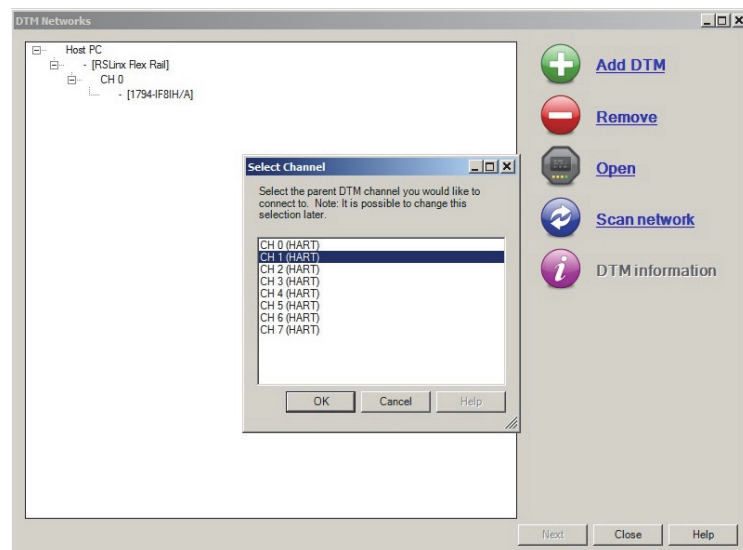
4. Select the FLEX rail.
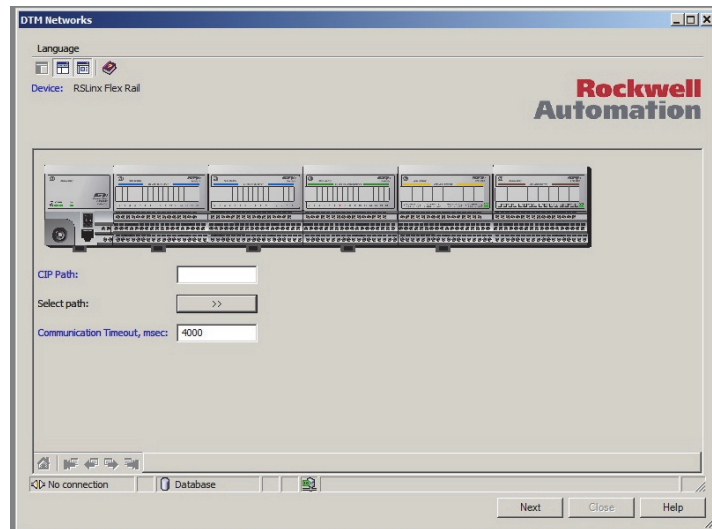
5. Use AutoBrowse to select the path.

Notes:

Chapter **4**
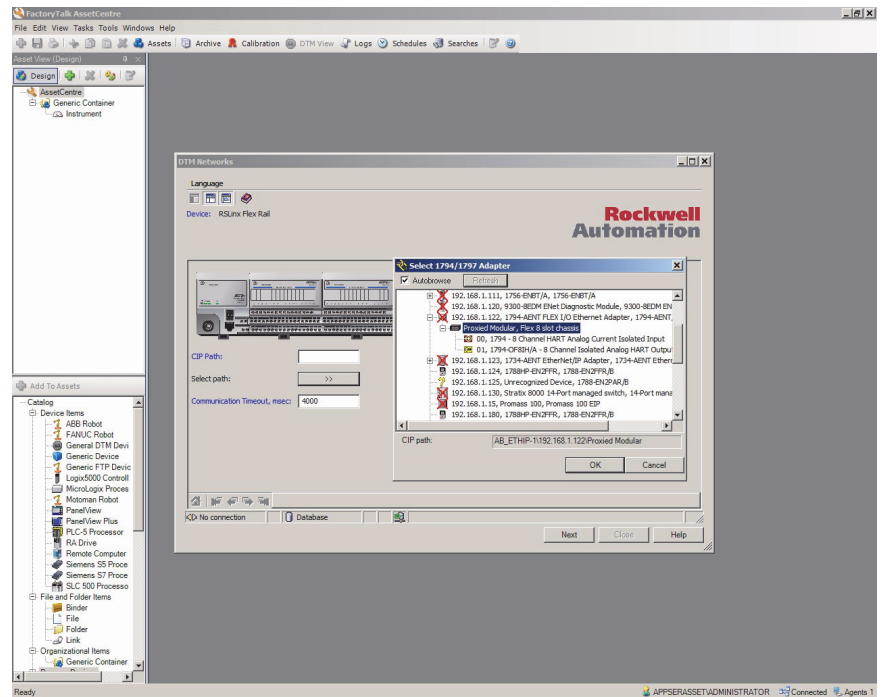
Configure the HART Device in E+H Fieldcare Software

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FieldCare is the Endress+Hauser FDT-based, plant-asset management tool for configuring intelligent field instruments.

Configure a HART Input Module and Device

1. Start FieldCare and open a new project.
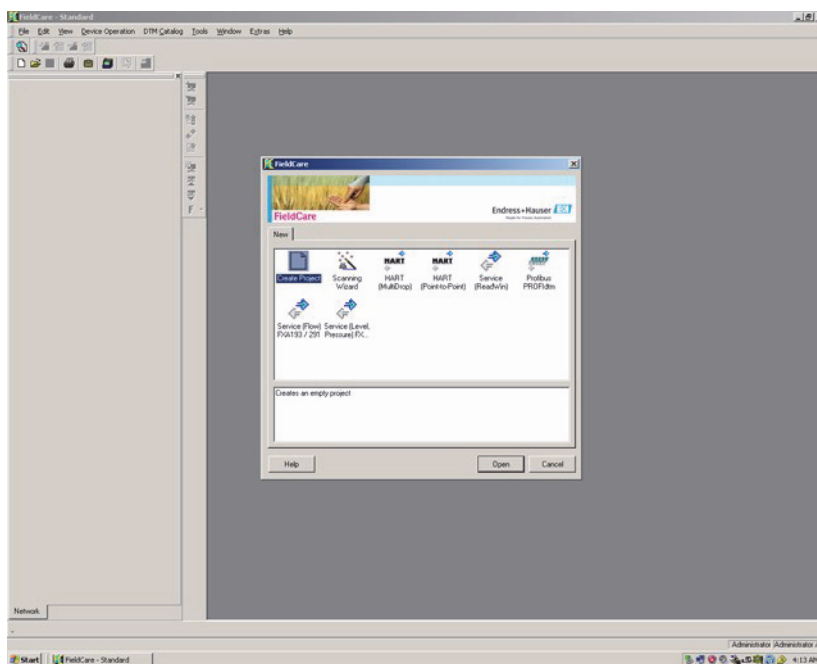
| IMPORTANT | To optimize FieldCare performance, it is recommended that you verify that the correct DTMs are loaded in the catalog. |

2. Choose DTM Catalog > Update.

3. Select desired DTMs and click Move.
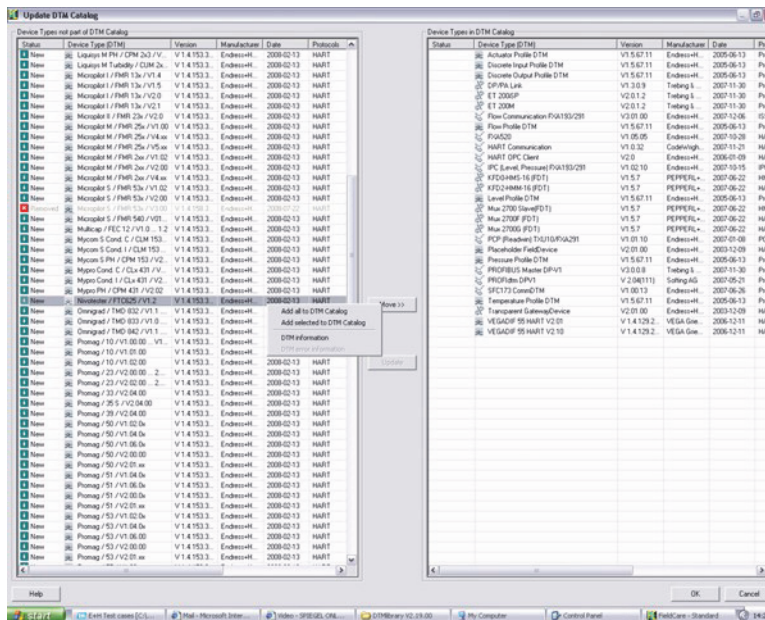
If you do not find the desired DTMs, or if the left pane of the dialog box is empty, click Update. FieldCare software searches for DTMs installed on your computer.

If necessary, to remove DTMs, select the desired DTMs in the right pane and click Move.

4. Click OK.

5. From the Device Operation/Add Device menu, select the RSLinx 1756 Backplane and click OK.
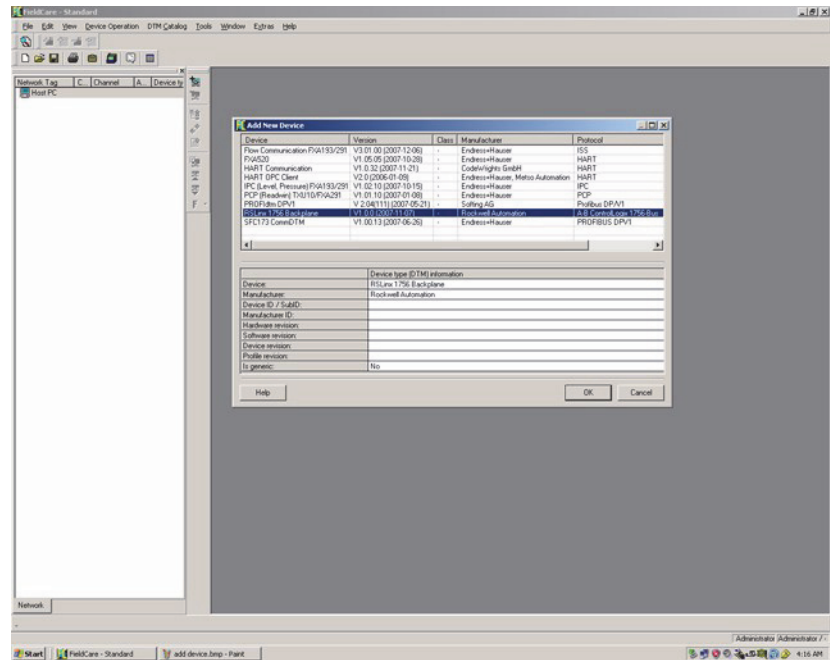
6. To configure the RSLinx backplane, double-click the RSLinx backplane in the left pane.

7. Click Select Path and browse to the backplane.
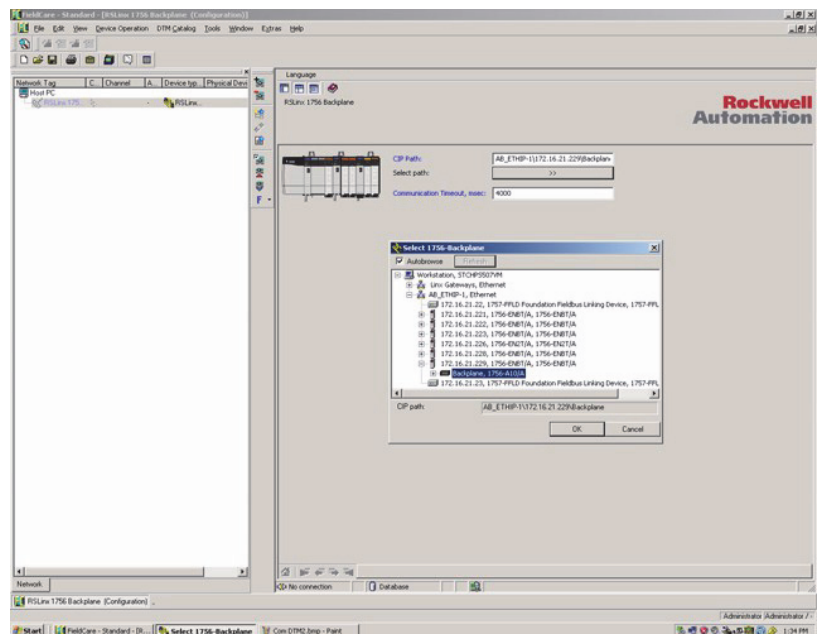
8. From the Device Operation/Add Device menu, select the 1756-IF8H/A module and click OK.
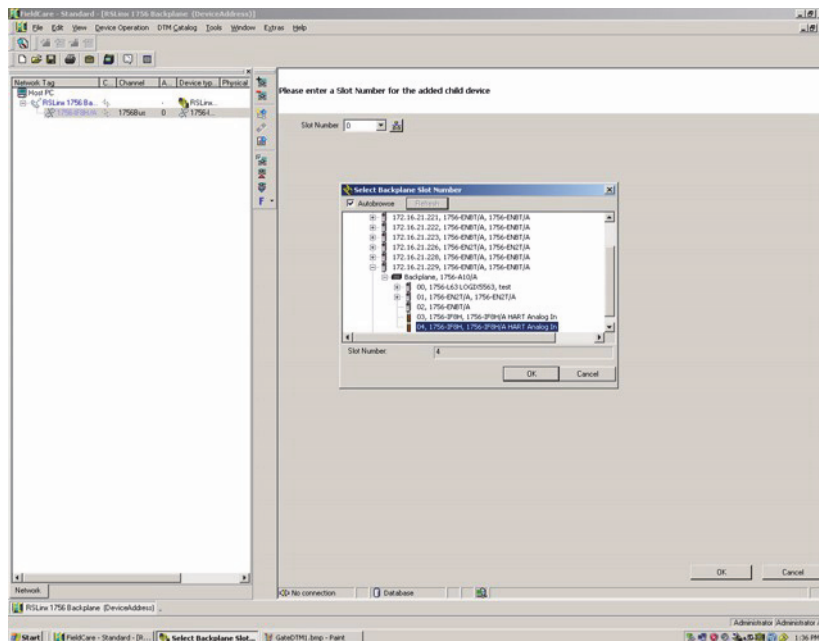
9. To configure the 1756-IF8H module, double-click the module backplane in the left pane.

10. Enter the slot number and click the Create Network icon.

11. When prompted, click OK.

The Com DTM now scans the entire HART network behind the multiplexer and searches for the right DTM.

If the right DTM is installed, the instrument displays the Explorer view on the left side.

If one DTM only is added to the network, the software automatically goes online. Otherwise, a warning occurs that must be confirmed. To switch this behavior off, in the Fieldcare-context-menu Extras/Options, select After Scanning within page Scanning.

Access Instrument Data

You can use FieldCare software to access instrument data.

The following examples show a Promass field instrument. The screens vary depending on the field instrument.

1. In an open FieldCare project, right-click the instrument in the left pane and choose Connect.

2. Double-click the instrument in the left pane.

3. In the Online pane, choose Device Data.
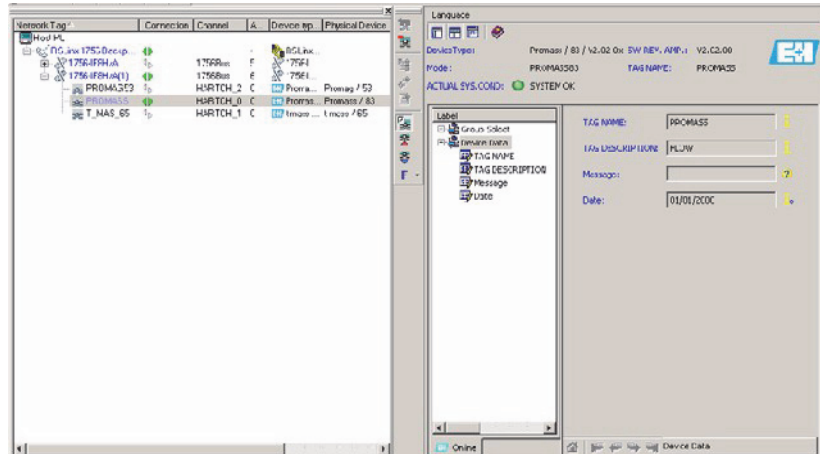
4. To view measured values, right-click the instrument in the left pane and choose Observe.
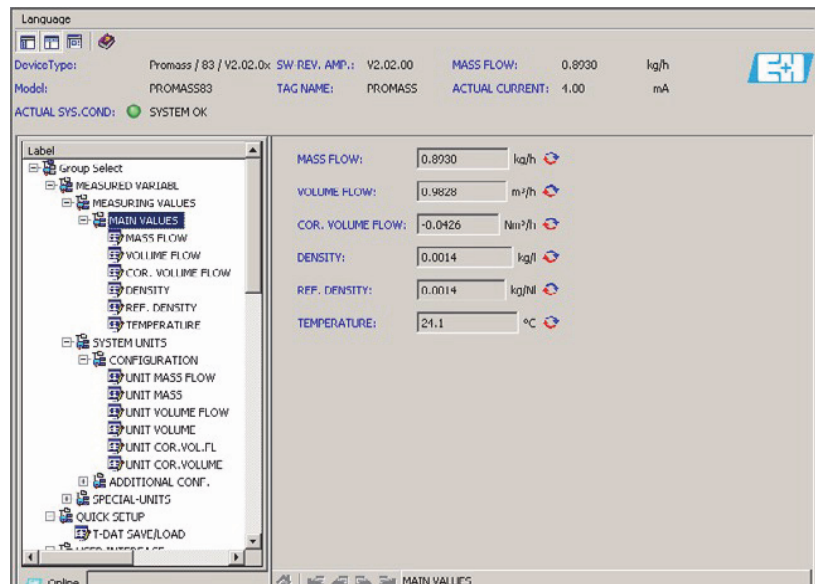
Additional Functions

You can use FieldCare software to perform these additional functions:

- Toggle between connected and disconnected modes
- Read from device
- Write to device
- Device-specific functions
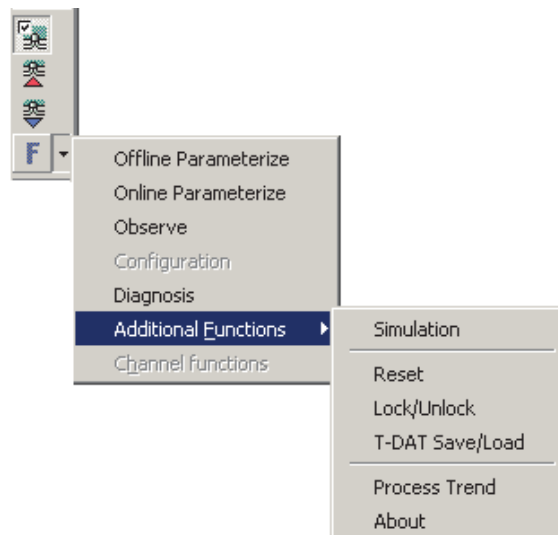
Visualization

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Configure I_AB56IFxH_Chan	72
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FactoryTalk View SE faceplates provide for visualization of instruments that are connected to a HART input module. The HART input module provides the necessary data to the faceplates. To use the pre-designed faceplates to monitor the instrument, HART must be enabled for the HART input module.

Add-On Instructions

Add-On Instructions provide the basis for an object-oriented programming methodology, where code is encapsulated into pre-validated modules that can be reused without modification. This lets you create standardized libraries that can both reduce project development time and provide consistency to reduce equipment startup and support costs. When using the PlantPAx device faceplates, you need to use the Add-On Instructions that are provided in the Rockwell Automation Library of Process Objects.

For more information, see the Rockwell Automation Library of Process Objects Reference Manual, publication PROCES-RM002.

The HART I/O provides the primary analog process variable, primary HART process variable, secondary HART process variable, tertiary process variable, and the fourth process variable along with status when HART is enabled.

There are pre-designed Add-On Instructions that exchange data between the faceplates and the controller. The name of the specific instance of the Add-On Instruction becomes the link from the actual instrument to the faceplate on the graphic.

Add-On Instruction	Description
I_AB56IF8H	Structured input data for each 1756-IF8H HART 8-channel input module. The I_AB56IF8H Add-On Instruction collects and organizes data from module parameters and from a module query that provides extra HART data via a CIP message from the controller to the I/O module.
I_AB56IF16H	Structured input data for each 1756-IF16H HART 16-channel input module. The I_AB56IF16H Add-On Instruction collects and organizes data from module parameters and from a module query that provides extra HART data via a CIP message from the controller to the I/O module.
I_AB56FxHChan	Structured data for each instrument. The I_AB56IFxH_Chan Add-On Instruction takes specific data from each channel and point and arranges it for the P_AIn56H Add-On Instruction. The I_AB56IFxH_Chan Add-On Instruction deciphers and prioritizes the HART Command 48 diagnostic message and sends the highest priority message (numerically) to the P_AIn56H Add-On Instruction.
P_AIn56H	Send the analog and process variable values from each instrument to one or more faceplates. The P_AIn56H Add-On Instruction uses embedded P_Mode and P_Alarm Add-On Instructions. The P_AIn56H Add-On Instruction organizes data in a similar fashion as other Library objects so operators can expect interaction to remain the same throughout the HMI.

IMPORTANT   The P_AIn56H Add-On Instruction uses embedded P_Mode and P_Alarm Add-On Instructions. These embedded Add-On Instructions must be already in the project before importing the P_AIn56H Add-On Instruction.

Download the Add-On Instructions

For the latest compatible software information and to download the Process Library, see the Product Compatibility and Download Center at http://www.rockwellautomation.com/rockwellautomation/support/downloads.page.

Import Add-On Instructions

To use the Add-On Instructions, you import them into a controller project. Complete these steps for each Add-On Instruction.

1. In the Controller Organizer, right-click Add-On Instructions and choose Import Add-On Instruction.
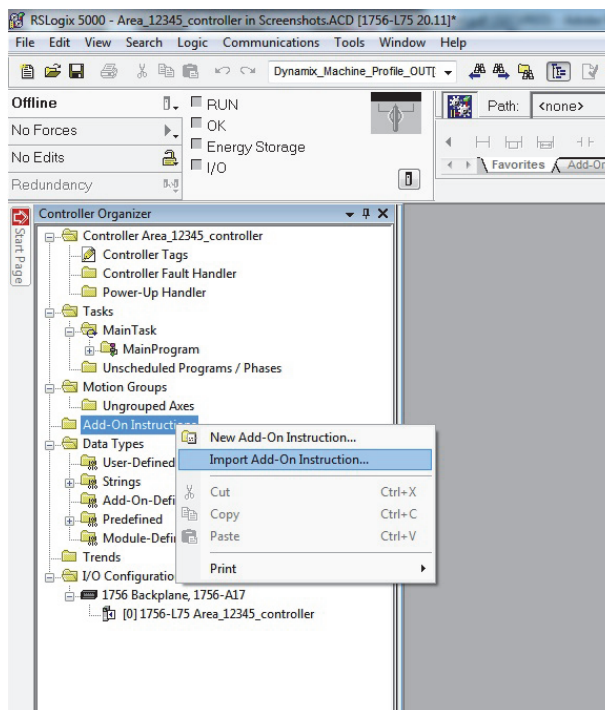
2. Select the Add-On Instruction to import from the File Explorer window and click Import.
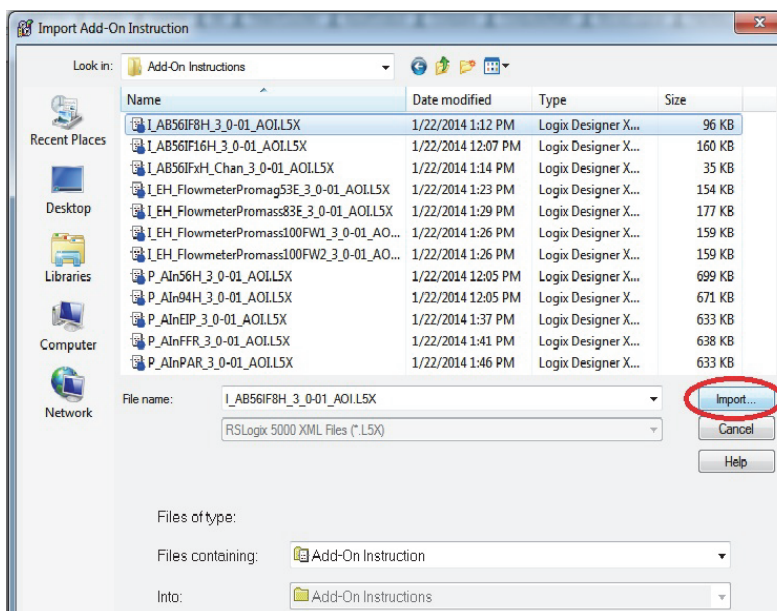
3. Click OK in the Import Configuration dialog box.
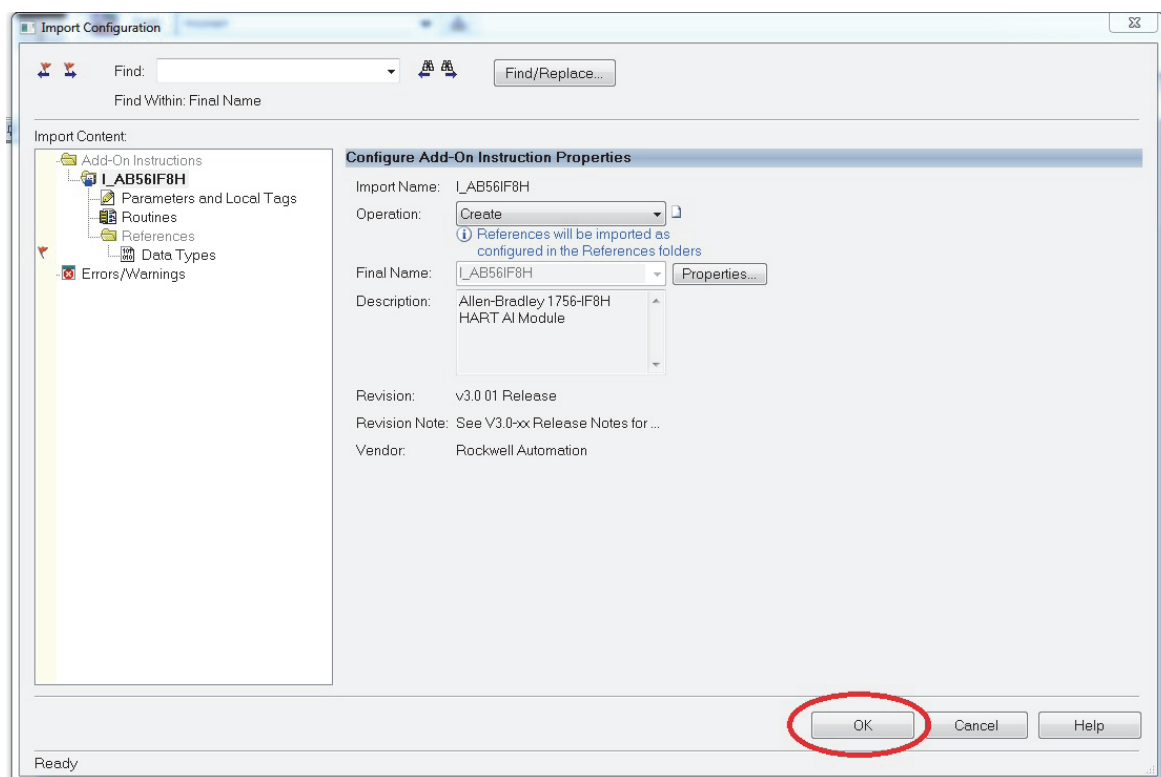
Once the import is complete, the Add-On Instructions and any additional data types are visible in the Controller Organizer.
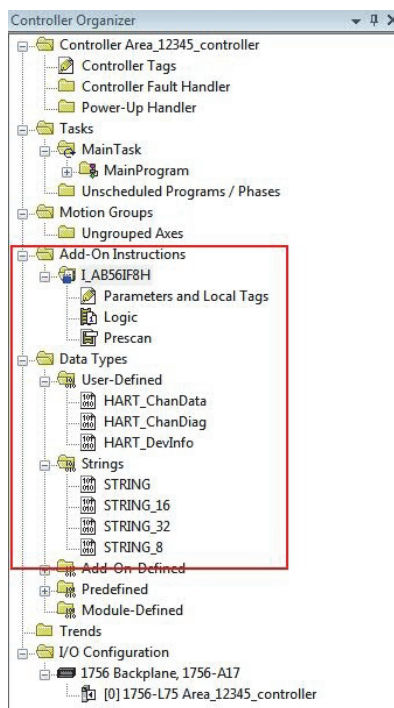
Add an Add-On Instruction to a Routine

Complete these steps to add an Add-On Instruction to a routine.

1. Open the routine by double-clicking the routine name in the Controller Organizer.

2. Right-click in field of the sheet and choose Add Element.
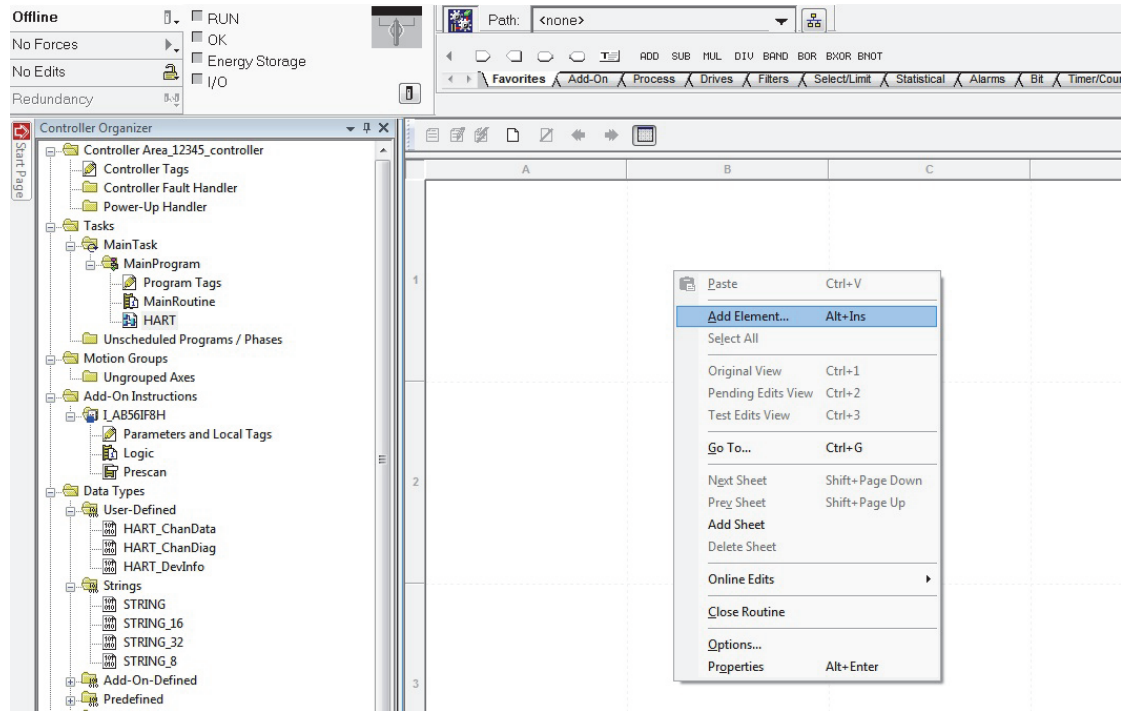
3. Browse to the Add-On Instruction folder, select the Add-On Instruction, and click OK.
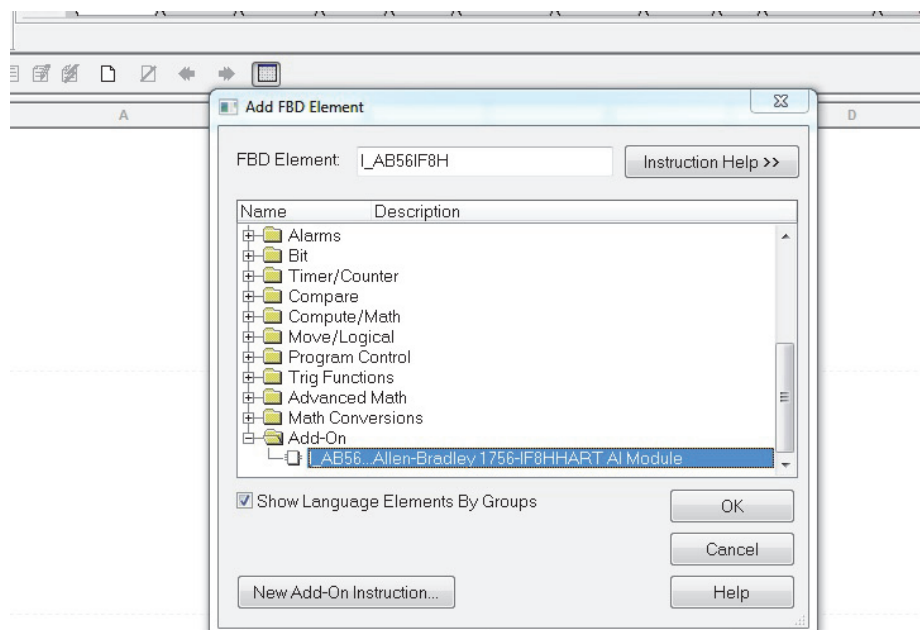
4. Repeat this process for each required Add-On Instruction.

Each analog input module needs the following:

- one I_AB56IF8H(for 8-channel) or I_AB56IF16H(for 16-channel)
- one I_AB56IFxH_Chan per HART device
- one P_AIn56H per device.

5. When all the Add-On Instructions are in the routine, connect them as shown.

Each I_AB56IFxH_Chan connects to one P_AIn56H.
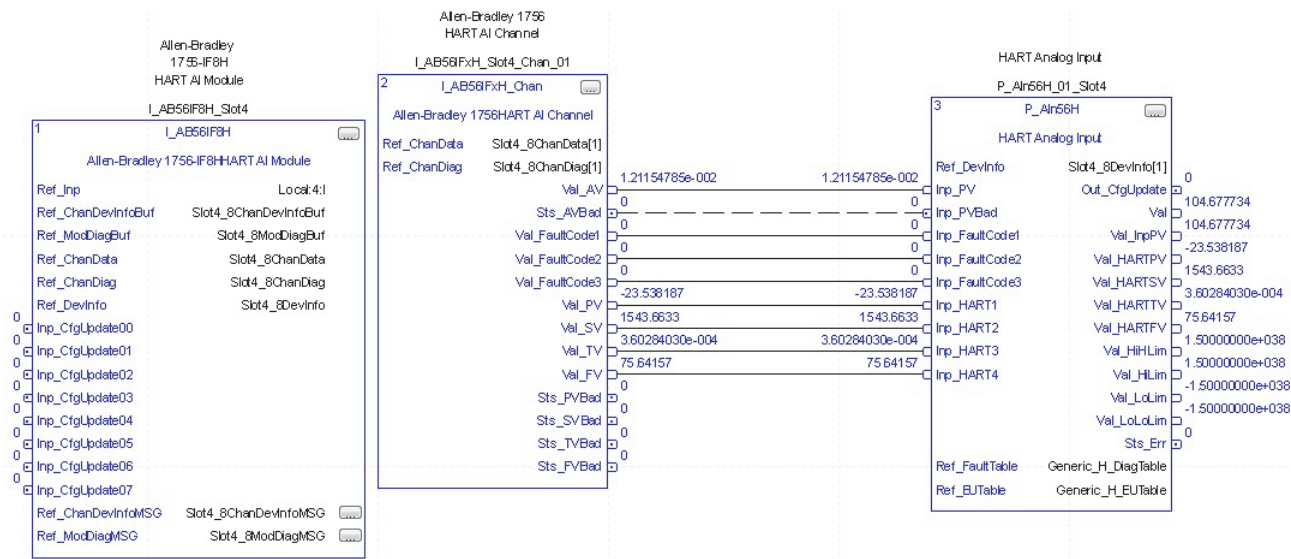
Configure I_AB56IF8H

Make the following modifications to each I_AB56IF8H Add-On Instruction.

1. You must create the backing tag and all of the reference input tags. Follow a system or naming convention for your application to keep multiple instances of this Add-On Instruction organized.

2. Configure the Ref_Inp tag to point to the location of the Analog HART Interface module in the chassis.
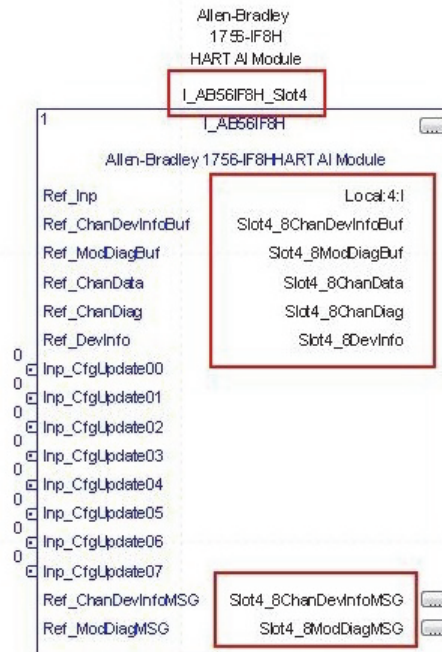
3. Configure the Ref_ChanDevInfoMSG tag so the path points to the Analog HART Interface module in the chassis.
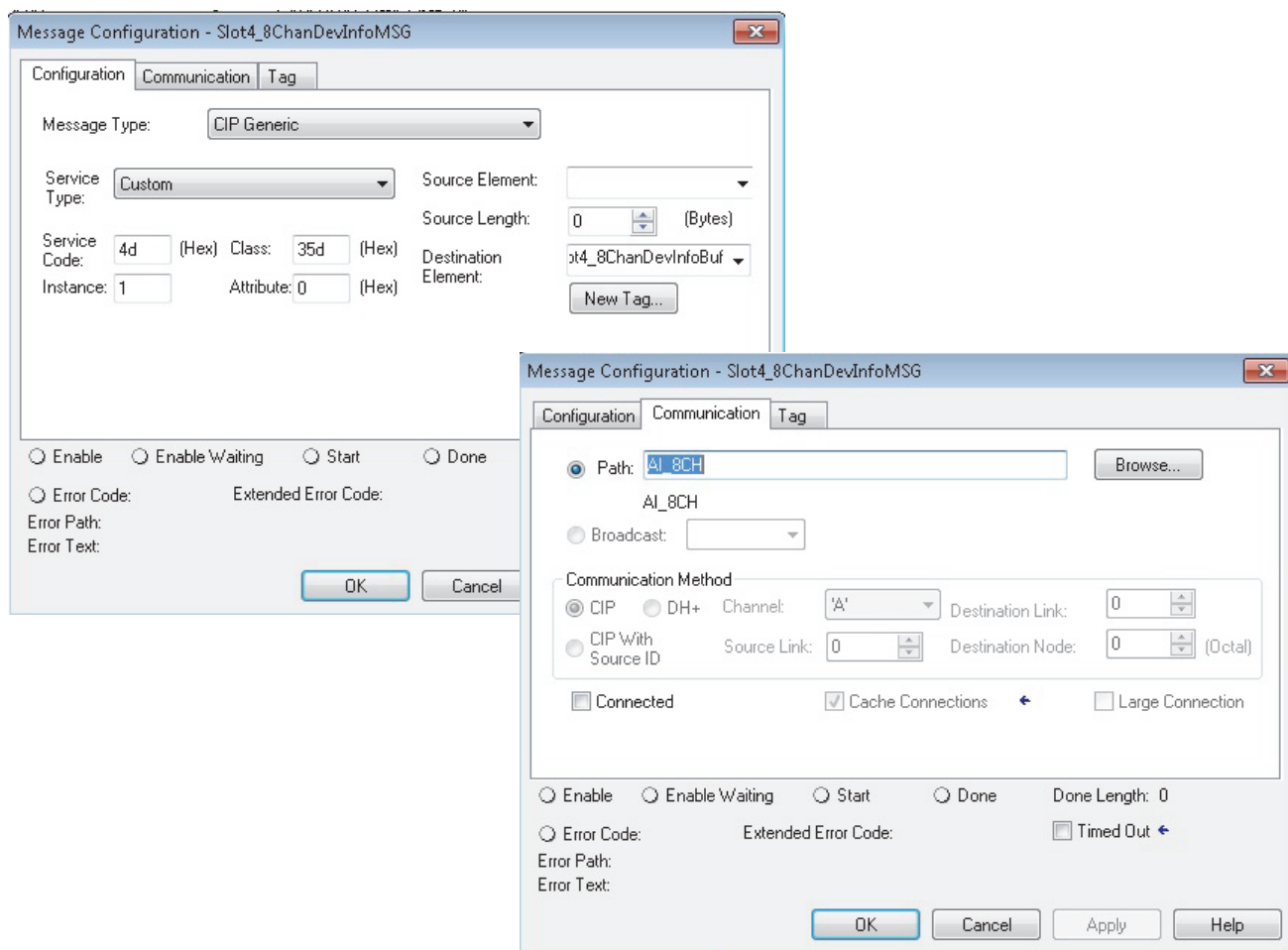
4. Configure the Ref_ModDiagMSG tag so the path points to the
    Analog HART Interface module in the chassis.
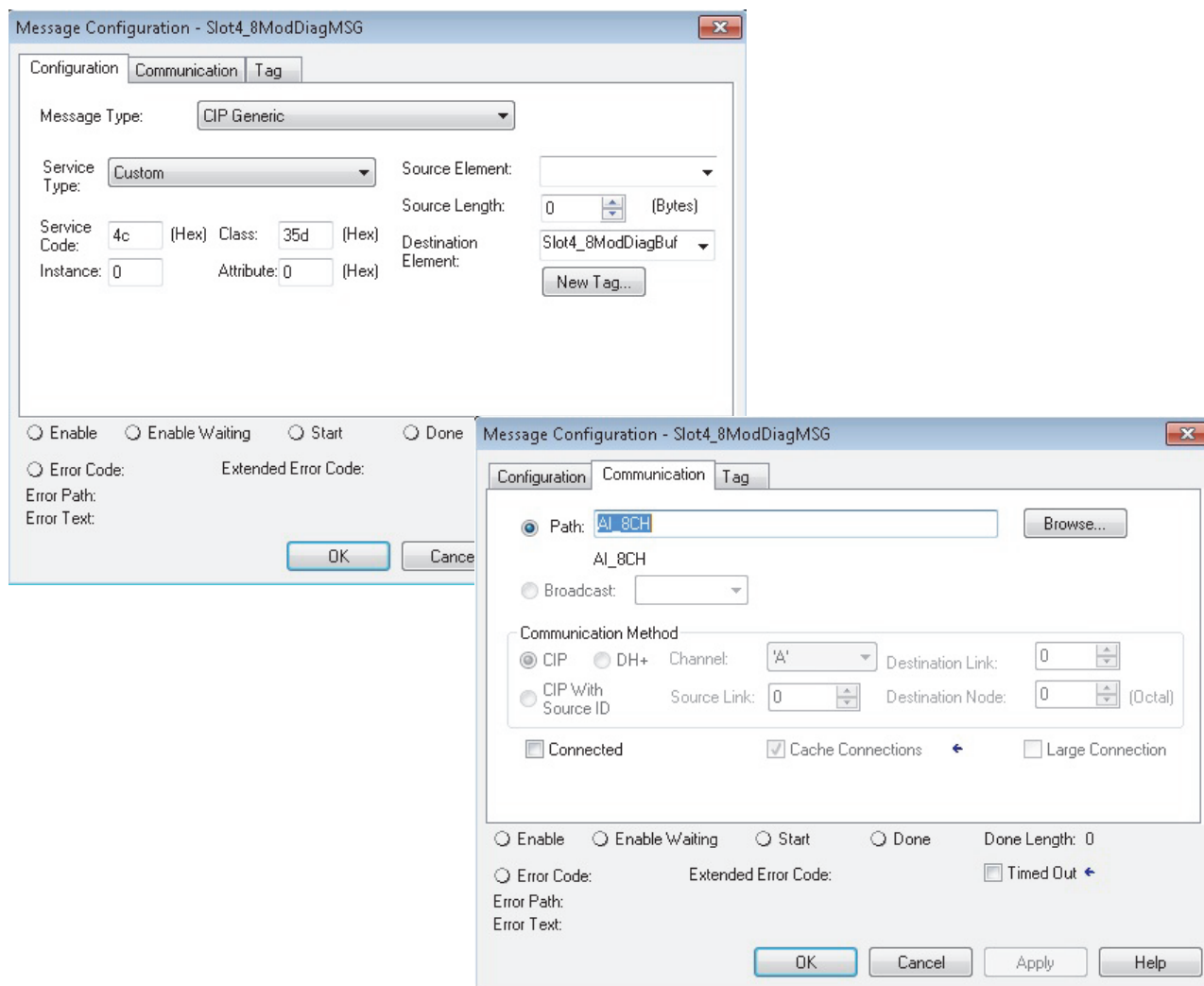
Configure I_AB56IFxH_Chan

Make the following modifications to the I_AB56IFxH_Chan Add-On Instruction.

1. You must create the backing tag. Follow a system or naming convention for your application to indicate the channel of the analog input module that it is referencing.

2. Configure Ref_ChanData and Ref_ChanDiag to point to the appropriate array channel position from the tags created in conjunction with I_AB56IF8H.
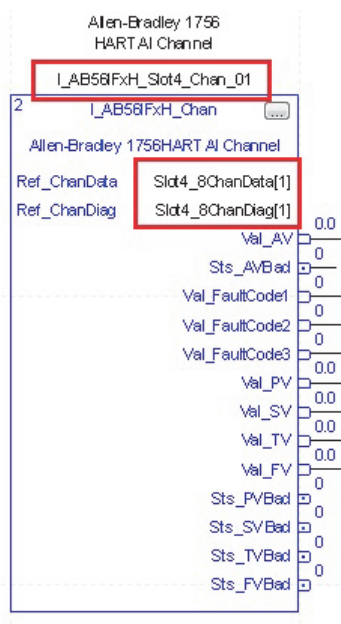
Configure P_AIn56H

Make the following modifications to the P_AIN56H Add-On Instruction.

1. You must create the backing tag. Follow a system or naming convention for your application to indicate the channel of the analog input module that it is referencing.

2. Configure Ref_DevInfo to point to the appropriate array channel position from the tags that are created in conjunction withI_AB56IF8H.

3. Configure the Ref_FaultTable and Ref_EUTable tags.

   These tables provide the fault codes and engineering units for the device. You can create your own table with device-specific codes and descriptions, or there are generic tables available in the sample projects that are contained within the Rockwell Automation® Library of Process Objects.
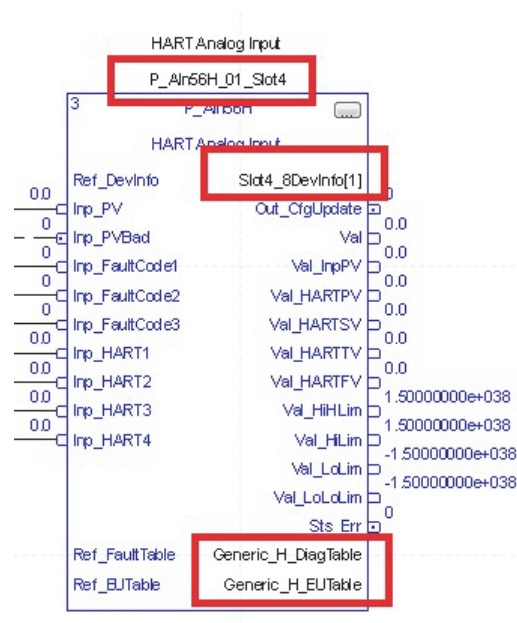
Faceplates

The FactoryTalk View SE generic display provides a graphical representation of the instrument that is based on the information that is contained within each Add-On Instruction.

– Navigation buttons at the top of the faceplate change the information displayed.

– Status displays show information by using a bar graph, numeric values, and a trend display.

– Other displays show specific alarms and warning indication.

Here are examples of pre-designed faceplates.

Home Screen   **Maintenance Screen**   **Engineering Screen**
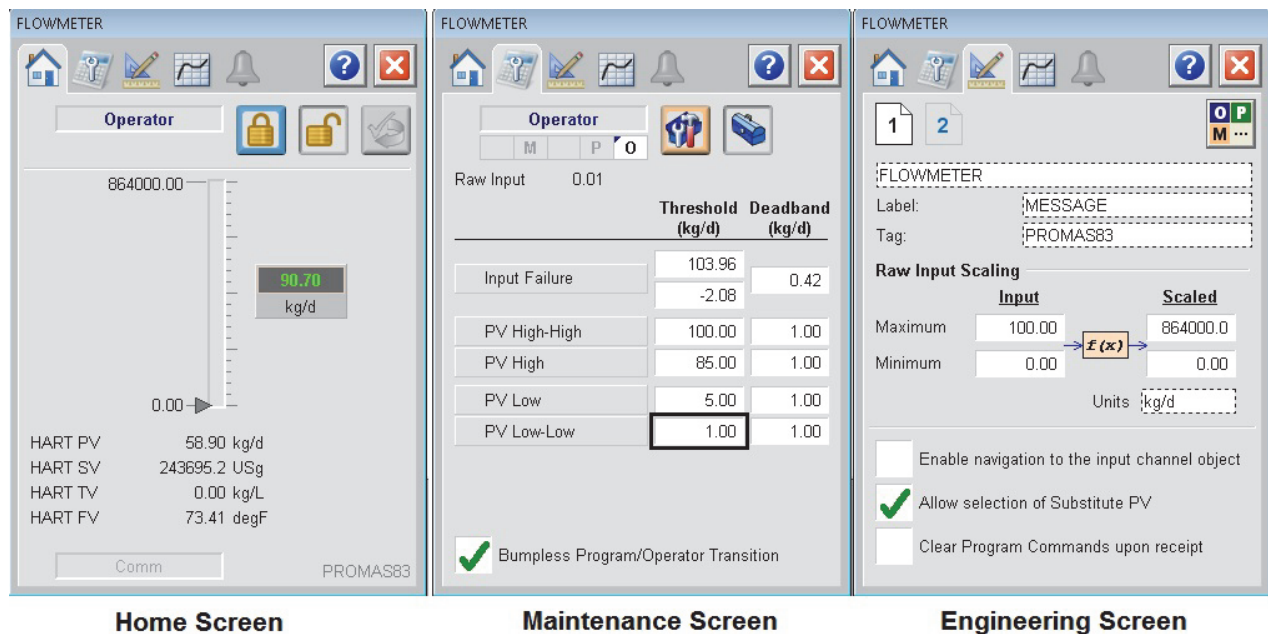
IMPORTANT	A unique global object and faceplates are available for each field instrument because of the display of instrument-specific diagnostic information. For details, see the Rockwell Automation Library of Process Objects Reference Manual, publication PROCES-RM002.

Faceplates provide the following information:

- Tag name from instrument
- Description from instrument
- Engineering units from instrument
- Analog process variable value (PV)
- Analog fault status (channel fault, broken wire, module fault)
- HART PV (first, second, third, fourth)
- HART PV fault status (first, second, third, fourth)
- HART PV range (minimum and maximum for each variable)
- HART command 48 diagnostic information

Configure the faceplates to provide the following:

- Mode (such as operator or program)
- High-high, high, low, and low-low alarms
- Over-range and under-range alarms
- Alarm delay
- Alarm deadband

For details on adding library components to HMI applications, see the Rockwell Automation Library of Process Objects Reference Manual, publication PROCES-RM002.

Notes:

Promag 53 Electromagnetic Flowmeter

Topic	Page
Connect a Promag 53 Flowmeter	79
Configure a Promag 53 Flowmeter	80

Component	Cat. No.	Details
Promag 53 electromagnetic flowmeter	53P15-EL081AA0BAAA	Firmware revision 2.01

Promag measuring instruments are electromagnetic flowmeters for bidirectional measurement of liquids. They provide cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The tried-and-tested Promag sensor offers the following:

- No pressure loss
- No sensitivity to vibrations
- Simple installation and commissioning

Faraday's law of induction states that a voltage is induced in a conductor moving in a magnetic field. In electromagnetic flowmetering, the flowing medium corresponds to the moving conductor. The induced voltage is proportional to the flow velocity and is detected by two measuring electrodes and transmitted to the amplifier. Flow volume is computed based on the pipe's diameter. The constant magnetic field is generated by a switched direct current of alternating polarity.
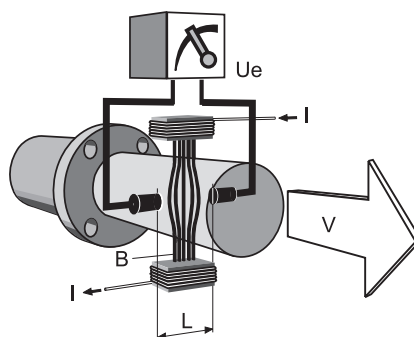
Item	Description
Ue	Induced voltage, $Ue = B \cdot L \cdot v$
B	Magnetic induction (magnetic field)
L	Electrode gap
V	Flow velocity
Q	Volume flow, $Q = A \cdot v$
A	Pipe cross-section
I	Current strength

Measured Variable

Volumetric flow rate (proportional to induced voltage)

Signals from Instrument to Control System

Signal	Details
Current Output	Active/passive selectable, galvanically isolated • Active: 0/4...20 mA, RL < 700 Ω (HART: RL ≥ 250 Ω) • Passive: 4...20 mA, operating voltage VS 18...30V DC, Ri ≤ 150 Ω
Pulse/Frequency Output	Active/passive selectable, galvanically isolated (Ex i version: only passive) • Active: 24V DC, 25 mA (max. 250 mA during 20 ms), RL > 100 Ω • Passive: open collector, 30V DC, 250 mA • Frequency output: full scale frequency 2...10000 Hz (f_{max} = 12500 Hz), EEx-ia: 2...5000 Hz; on/off ratio 1:1; pulse width max. 10 s • Pulse output: pulse value and pulse polarity adjustable, pulse width configurable (0.05...2000 ms)

Connect a Promag 53 Flowmeter

Use a 4-wire connection to the HART input module.

1. Remove the cover of the connection compartment (f) from the transmitter housing.

2. Feed the power supply cable (a) and signal cables (b) through the appropriate cable entries.

3. Connect the HART communications cable to the HART connector in the order white (+), black (-) on pins 26, 27 of the connector.

4. For AC powered instruments, connect the AC cable to the power connector in the order ground (as shown), black (pin1), white (pin2).

5. Screw the cover of the connection compartment (f) firmly onto the transmitter housing.
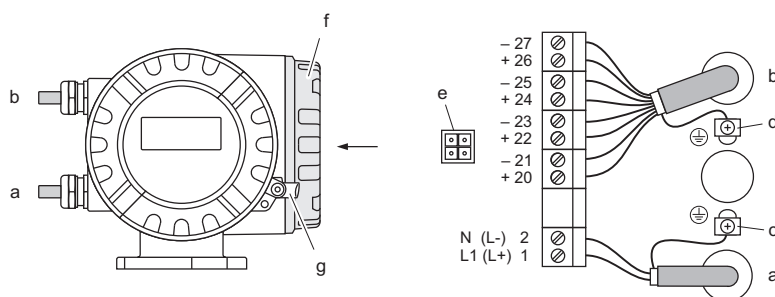
Item	Description
a	Cable for power supply: 85…260V AC, 20…55V AC, 16…62V DC • Terminal No. 1: L1 for AC, L+ for DC • Terminal No. 2: N for AC, L- for DC
b	Signal cable: Terminal Nos. 20-27
c	Ground terminal for protective conductor
d	Ground terminal for signal cable shield
e	Service adapter for connecting service interface FXA 193 (FieldCheck, FieldCare)
f	Cover of the connection compartment
g	Securing clamp

Configure a Promag 53 Flowmeter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Pulsating Flow

Batching

```
  xxx.xxx.xx
  ⎡□□□⎤  →  E  →  +  →    Quick Setup        B
  └───┘

  HOME-POSITION                              E
                                             ↓
                                    QS              1005
                                  Batching/Dosing

                                   ON-Value         6402
                                  Low flow cut off

                                   System           6603
                                   damping

                                 Pressure shock     6404
                                 suppression

                                   Batch            7200
                                  Selector

                                   Batch            7201
                                   Name

                                   Batch            7203
                                  Quantity

                                    Fix             7204
                              Compensation Quantity

                                   Select
               Relay 1         Output?            Relay 2

                                   Assign          4700
                                   Relay

                                 Terminal No.      4780

                                   Batch
                YES            Supervision?          NO

                              Max. Batch   7240
                                 Time

                              Autom. Configuration
                YES               Display?            NO

                                  PRESET
              Locked           Batch quantity   Access Customer

                          Automatic parameterization
                                of the display

                               Quit Quick Setup
```

Proline t-mass 65 Thermal Flowmeter

Topic	Page
Connect a Proline t-mass 65 Flowmeter	85
Configure a Proline t-mass 65 Flowmeter	86

Component	Cat. No.	Details
Proline t-mass 65 thermal mass flowmeter	65I-20AA0AD1A1BABA	Firmware revision 1.00

The Proline t-mass thermal flowmeter provides direct measurement of gas mass flow and temperature as an output.

The t-mass sensor offers the following information:

- Negligible pressure drop or loss
- Wide turndown of up to 100:1
- Insertion version can be programmed for circular pipe or rectangular ducting installation
- Each device individually calibrated and delivered with a traceable certificate
- Can be calibrated with flow conditioner on request
- Optional cold tap device for insertion that provides for ease of removal/replacement for low pressure and non-toxic gas applications

The thermal principle operates by monitoring the cooling effect of a gas stream as it passes over a heated transducer (PT100). Gas flowing through the sensing section passes over two PT 100 RTD transducers, one of which is used conventionally as a temperature sensing device, while the other is used as a heater.

The temperature sensor monitors the actual process values while the heater is maintained at a constant differential temperature above this by varying the power consumed by the sensor. The greater the mass flow, the greater the cooling effect and power required to maintain the differential temperature. The measured heater power is. therefore, a measure of the gas mass flow rate.
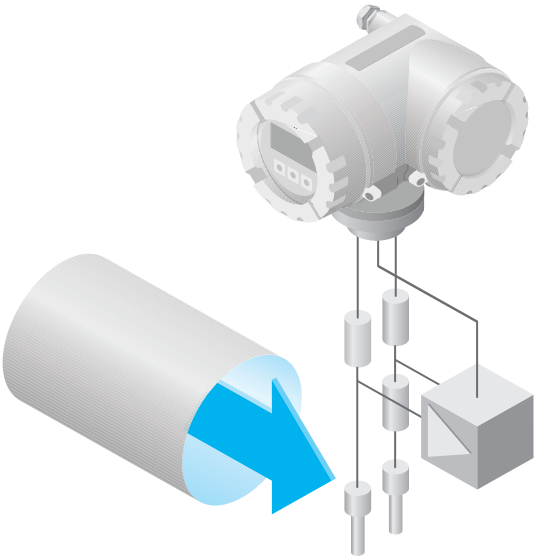
Measured Variables

- Mass flow
- Gas temperature

Signals from Instrument to Control System

Signal	Details
Current Output	Active/passive selectable, galvanically isolated • Active: 0/4…20 mA, RL < 700 Ω (at HART: RL ≥ 250 Ω) • Passive: 4…20 mA, Ri ≥ 150 Ω, Umax = 30V DC
Pulse/Frequency Output	• Active: 24V DC, 25 mA (max. 250 mA during 20 msec), RL > 100 Ω • Passive, open collector, 30V DC, 250 mA, galvanically isolated • Frequency output: full scale frequency 2…1000 Hz (fmax = 1250 Hz), on/off ratio 1:1, pulse width max. 2s, time constant selectable (0.0…100.0s) • Pulse output: pulse value and pulse polarity selectable, pulse width adjustable (0.5…2000 ms)

IMPORTANT   If the current output is used as a temperature output, observe the information for Class B according to EN 6075.

Connect a Proline t-mass 65 Flowmeter

Use a 4-wire connection to the HART input module.

1. Unscrew the connection compartment cover (f) from the transmitter housing.

2. Feed the power supply cable (a) and the signal cable (b) through the appropriate cable entries.

3. Connect the HART communications cable to the HART connector in the order white (+), black (-) on pins 26, 27 of the connector.

4. For AC powered instruments, connect the AC cable to the power connector in the order ground (as shown), black (pin 1), white (pin 2).

5. Screw the cover of the connection compartment (f) back onto the transmitter housing.
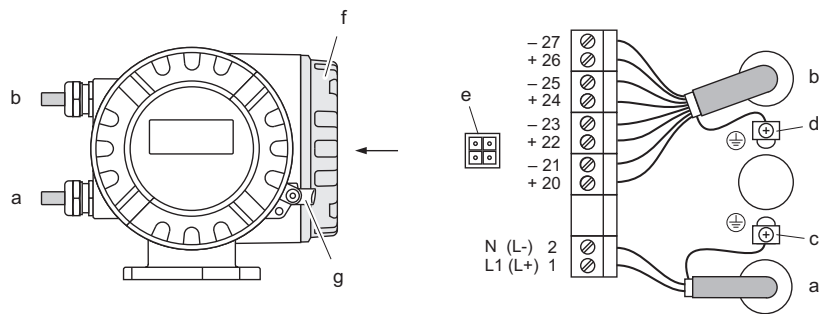
Item	Description
a	Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC • Terminal No. 1: L1 for AC, L+ for DC • Terminal No. 2: N for AC, L- for DC
b	Signal cable: Terminals Nos. 20-27
c	Ground terminal for protective earth
d	Ground terminal for signal cable shield
e	Service adapter for connecting service interface FXA193 (FieldCheck, FieldCare)
f	Cover of the connection compartment
g	Securing clamp

Configure a Proline t-mass 65 Flowmeter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.
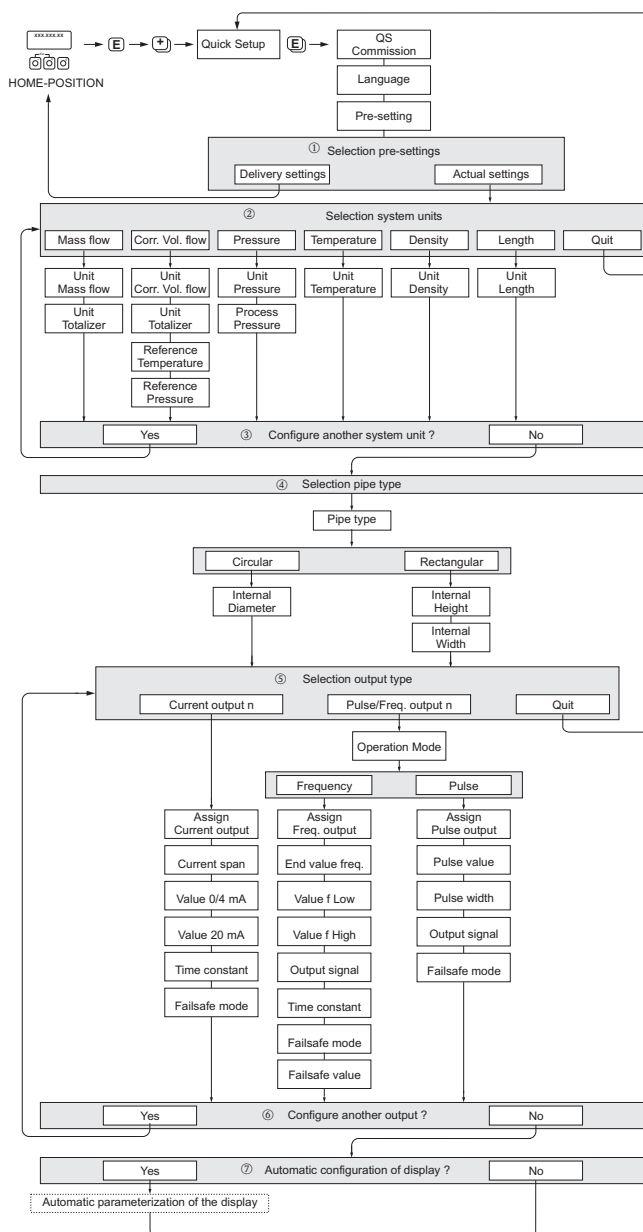
Promass 83 Coriolis Mass Flowmeter

Topic	Page
Connect a Promass 83 Flowmeter	89
Configure a Promass 83 Flowmeter	90

Component	Cat. No.	Details
Promass 83 mass flowmeter	83E08-AAASAAAAABANB	Firmware revision 2.02

Promass measuring instruments make it possible to simultaneously record several process variables (mass, density, temperature) for various process conditions during measuring operation. Promass sensors, tried and tested in over 100,000 applications, offer the following:

- Multivariable flow measurement in compact design
- Insensitivity to vibrations from balanced two-tube measuring system
- Immunity from external piping forces because of robust design
- Easy installation without taking inlet and outlet runs into consideration

The measuring principle is based on the controlled generation of Coriolis forces. In the sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations. At zero flow, when the fluid is at a standstill, the two tubes oscillate in phase (1). Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).
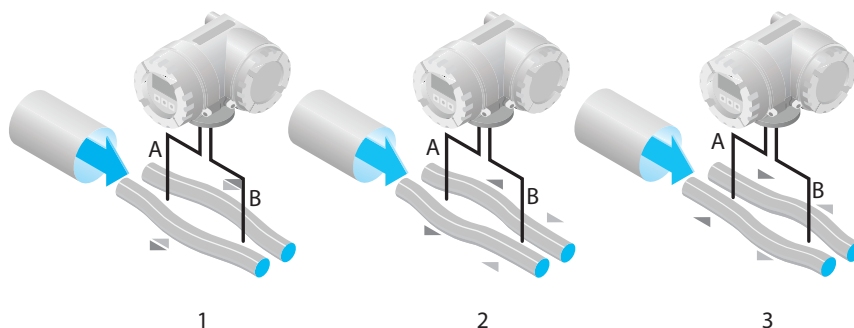
The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is secured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity, and flow profile.

Measured Variables

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Volume flow (calculated from mass flow and fluid density. The density is proportional to the resonance frequency of the measuring tubes.)
- Measuring tube temperature (by temperature sensors) for calculatory compensation of temperature effects
- Density, by monitoring the tube frequency, is directly proportional to medium density
- Totalized flow (application dependent by using pulse output)

Signals from Instrument to Control System

Signal	Details
Current Signal	Active/passive selectable, galvanically isolated. • Active: 0/4…20 mA, R_L < 700 Ω (for HART: $R_L \geq$ 250 Ω) • Passive: 4…20 mA; supply voltage U_S 18…30V DC; $R_i \geq$ 150 Ω
Pulse/Frequency Signal	Active/passive selectable, galvanically isolated. • Active: 24V DC, 25 mA (max. 250 mA during 20 ms), RL > 100 Ω • Passive, open collector, 30V DC, 250 mA • Frequency output: full scale frequency 2…10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s • Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05…2000 ms)

Connect a Promass 83 Flowmeter

Use a 4-wire connection to the HART input module.

Supply 100V AC power to the field instrument. Connect instrument communication to the HART terminals. The sensor was pre-installed at the factory.

1. Remove the cover of the connection compartment (f) from the transmitter housing.

2. Feed the power supply cable (a) and signal cables (b) through the appropriate cable entries

3. Connect the HART communications cable to the HART connector in the order white (+), black (-) on pins 26, 27 of the connector.

4. For AC powered instruments, connect the AC cable to the power connector in the order ground (as shown), black (pin 1), white (pin 2).

5. Screw the cover of the connection compartment (g) firmly onto the transmitter housing.
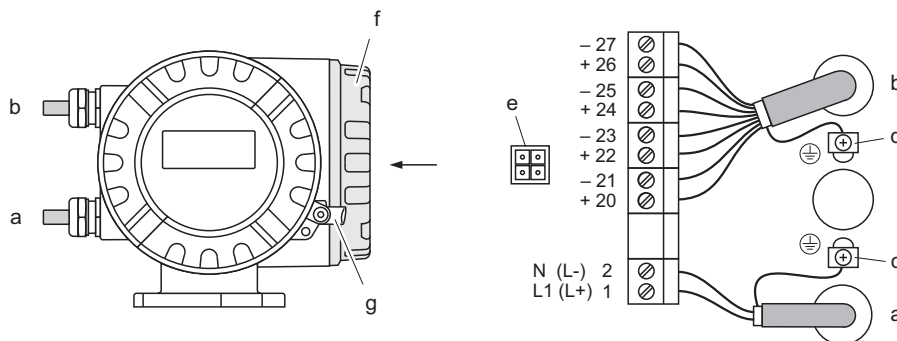
Item	Description
a	Cable for power supply: 85…260V AC, 20…55V AC, 16…62V DC
b	Signal cable
c	Ground terminal for protective conductor
d	Ground terminal for signal cable shield
e	Service adapter for connecting service interface FXA 193 (Fieldcheck, FieldCare)
f	Cover of the connection compartment
g	Securing clamp

Configure a Promass 83 Flowmeter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Prowirl 73 Flowmeter

Component	Cat. No.	Details
Prowirl 73 vortex flow meter	73W15-SK4AA1AAB4AA	Firmware revision 1.03

The Prowirl measurement instrument provides the following:

- Complete saturated steam or liquid-mass measuring point in one single device
- Calculation of the mass flow from the measured variables volume flow and temperature in the integrated flow computer
- External pressure value read-in for superheated steam and gas applications (optional)
- External temperature value read-in for delta heat measurement (optional)

The robust Prowirl sensor, tried and tested in over 100,000 applications, offers the following:

- High resistance to:
  - vibrations (over 1g in all axes)
  - temperature shocks (>150 K/s)
  - contaminated media
  - water hammer
- No maintenance, no moving parts, no zero-point drift ('lifetime' calibration)
- Software initial settings save time and costs

Vortex meters work on the principle of the Karman vortex street. When fluid flows past a bluff body, vortices are alternately formed on both sides with opposite directions of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to electrical pulses. The vortices develop very regularly within the permitted application limits of the device. Therefore, the frequency of vortex shedding is proportional to the volume flow.
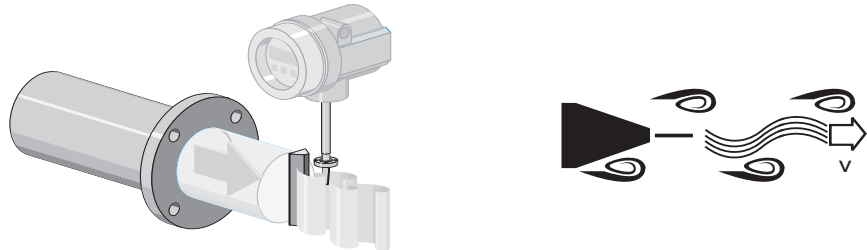
The K-factor is used as the proportional constant:

$$K\text{-Factor} = \frac{\text{Pulses}}{\text{Unit Volume [dm}^3\text{]}}$$

Measured Variables

- Volumetric flow (volume flow) is proportional to the frequency of vortex shedding after the bluff body.
- The temperature can be output directly and is used to calculate the mass flow for example.
- The measured process variables volume flow, temperature or the calculated process variables mass flow, heat flow, or corrected volume flow can be output as the output variables.

Signals from Instrument to Control System

Signal	Details
Current Output	• 4…20 mA with HART • Full scale value and time constant (0…100 s) can be set

Frequency Output, Pulse/Status Output	Frequency output (optional): open collector, passive, galvanically isolated
	• Non-Ex, Ex d/XP version:
	  – Umax = 36V, with 15 mA current limiting, Ri = 500 Ω
	• Ex i/IS and Ex n version:
	  – Umax = 30V, with 15 mA current limiting, Ri = 500 Ω
	
	Frequency output:
	• End frequency 0…1000 Hz (fmax = 1250 Hz)
	
	Pulse output:
	• Pulse value and polarity can be selected (5…2000 ms)
	• Pulse width can be configured (0.005…to 2 s)
	• Pulse frequency 100 Hz max
	
	Status output:
	• Can be configured for error messages or flow values, temperature values, pressure limit values
	
	Vortex frequency:
	• Direct output of unscaled vortex pulses 0.5…2850 Hz (for example. connecting to an RMC621 flow computer)
	• Pulse ratio 1:1

Connect a Prowirl 73 Flowmeter

Use a 2-wire connection to the HART input module.

1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.

2. Remove the display module (b) from the retaining rails (c) and refit onto right retaining rail with the left side (this secures the display module).

3. Loosen screw (d) of the cover of the connection compartment and fold down the cover.

4. Push the cable for the power supply/current output through the cable gland (e).

   Optional: Push the cable for the pulse output through the cable gland (f).

5. Tighten the cable glands (e/f).

6. Pull the terminal connector (g) out of the transmitter housing and connect the cable for the power supply/current output (see wiring diagram).

   Optional: Pull terminal connector (h) out of the transmitter housing and connect the cable for the pulse output (see wiring diagram).

IMPORTANT	The terminal connectors (g/h) can be plugged out of the transmitter housing to connect the cables.

7. Plug the terminal connectors (g/h) into the transmitter housing.

| IMPORTANT | The connectors are coded so you cannot mix them up. |

8. Fold up the cover of the connection compartment and tighten the screws (d).

9. Remove the display module (b) and fit on the retaining rails (c).

10. Screw the cover of the electronics compartment (a) onto the transmitter housing.

11. Only remote version: Secure the ground cable to the ground terminal (see wiring diagram, c).
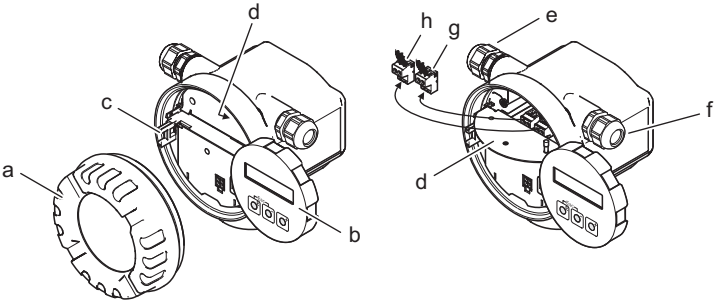
Item	Description
a	Cover of electronics compartment
b	Display module
c	Retaining rail for display module
d	Connection compartment cover threaded connection
e	Cable gland for power supply/current output cable
f	Cable gland for pulse output cable (optional)
g	Terminal connector for power supply/current output
h	Terminal connector for pulse output (optional)
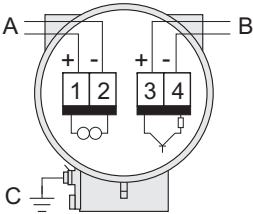
Item	Description
A	Power supply/current output
B	Optional frequency output. Can also be operated as the following: • Pulse or status output • Together with flow computer RMS or RMS621 as PFM output
C	Ground terminal (relevant only for remote control)

Configure a Prowirl 73 Flowmeter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters. Local display and menus on the instrument.

→ Ⓔ → ⊞ → Quick Setup → Ⓔ → | Quick Setup Commissioning |

| Language |

m   Select Fluid   s ℓ

| Saturated Steam | Gas volume | Liquid volume | Water | User defined liquid | Compressed air | Superheated Steam | Real gas | Natural gas NX-19 | Water Delta heat |

| Unit mass flow | Unit volume flow | Unit volume flow | Unit volume flow | Temperature value | Reference temperature | r Pressure type | Unit Corr. vol. flow | Unit Corr. vol. flow | Satur. steam Delta heat |

| Unit totalizer 1 | Unit totalizer 1+2 | Unit totalizer 1+2 | Unit totalizer 1 | Unit density | r Pressure type | Ambient / Oper. pressure | Unit totalizer 1 | Unit totalizer 1 | Unit volume flow |

| Unit heat flow | | | Unit heat flow | Density value | Ambient / Oper. pressure | Unit mass flow | Unit volume flow | Unit volume flow | Unit totalizer 1 |

| Unit totalizer 2 | | | Unit totalizer 2 | Expansion coefficient | Unit Corr. vol. flow | Unit totalizer 1 | Unit totalizer 2 | Unit totalizer 2 | Unit totalizer 2 |

| | | | | Unit mass flow | Unit totalizer 1 | Unit heat flow | | | |

| | | | | Unit totalizer 1 | Unit volume flow | Unit totalizer 2 | | | |

| | | | | Unit volume flow | Unit totalizer 2 | | | | |

| | | | | Unit totalizer 2 | | | | | |

| Current output | Frequency output | n   Selection output type | Quit |

| Selection frequency | Selection pulse | Selection status |

Assign current	Assign frequency	Assign pulse	Assign status
Current range	End value frequency	Pulse value	Switch on point
Value 4 mA	Value f low	Pulse width	Switch off point
Value 20 mA	Value f high	Output signal	Time constant
Time constant	Output signal	Failsafe mode	
Failsafe mode	Time constant		
	Failsafe mode		

| Yes | o   Configure another output ? | No |

| Yes | p   Automatic configuration of display ? | No |

| Automatic parameterization of the display |

Only by selection:
Real gas,
Natural gas NX-19

| YES (recommended) | Call up the group FLOW COMPUTER ? | No |

| The group FLOW COMPUTER is called up | q

Notes:

Prosonic M Ultrasonic Level

Topic	Page
Connect a Prosonic M Ultrasonic Level	99
Configure a Prosonic M Ultrasonic Level	101

Component	Cat. No.	Details
Prosonic M ultrasonic level	FMU40-ANB2A4	Firmware revision 1.04

Prosonic measurement instruments provide continuous, non-contact level measurement in fluids, pastes, sullages, and coarse bulk materials. This provides flow measurement in open channels and measuring weirs.
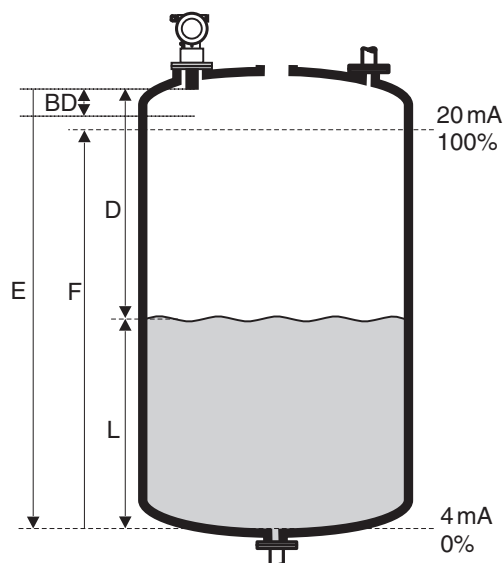
Item	Description
E	Empty distance
F	Span (full distance)
D	Distance from sensor membrane - product surface
L	Level
BD	Blocking distance

The sensor of the Prosonic M transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The Prosonic M measures the time between pulse transmission and reception. The instrument uses the time (and the velocity of sound 'c') to calculate the distance 'D' between the sensor membrane and the product surface:

$$D = c \cdot t/2$$

As the device uses the empty distance 'E' from a user entry, it can calculate the level as follows:

$$L = E - D$$

An integrated temperature sensor compensates for changes in the velocity of sound that is caused by temperature changes. The interference echo suppression feature on the Prosonic M makes sure that interference echos (for example, from edges, welded joints, and installations) are not interpreted as a level echo. Enter the empty distance 'E' and the span 'F' to calibrate the device. Span 'F' possibly does not extend into the blocking distance 'BD'. Level echos from the blocking distance cannot be evaluated due to the transient characteristics of the sensor.

Measured Variables

The distance 'D' between the sensor membrane and the product surface is measured. Using the linearization function, the device uses 'D' to calculate the following:

- Level 'L' in any units
- Volume 'V' in any units
- Flow 'Q' across measuring weirs or open channels in any units

Signals from Instrument to Control System

Signal	Details
Current Output	4...20 mA with HART protocol (Minimum load for HART communication: 250Ω)
Frequency Output	FMU40 - approx. 70 kHz FMU41 - approx. 50 kHz FMU42 - approx. 42 kHz FMU43 - approx. 35 kHz FMU44 - approx. 30 kHz
Output Damping	Freely selectable, 0...225 s

Connect a Prosonic M Ultrasonic Level

Use a 2-wire connection to the HART input module.

1. Unscrew housing cover (1).

2. Remove display (2), if fitted.

3. Remove cover plate (3) from terminal compartment.

4. Pull out the terminal module (4) slightly by using a pulling loop.

5. Insert a cable (5) through the gland (6).

> ⚠ **ATTENTION:** If possible, insert the cable from above and let a draining loop to avoid intrusion of humidity.

6. Connect cable screen to the grounding terminal (7) within the terminal compartment.

7. Make connection according to terminal assignment.

8. Re-insert terminal module (4).

9. Tighten cable gland (6).

10. Tighten screws on cover plate (3).

11. Insert display (2), if fitted.

12. Screw on housing cover (1).

13. Switch on power supply.
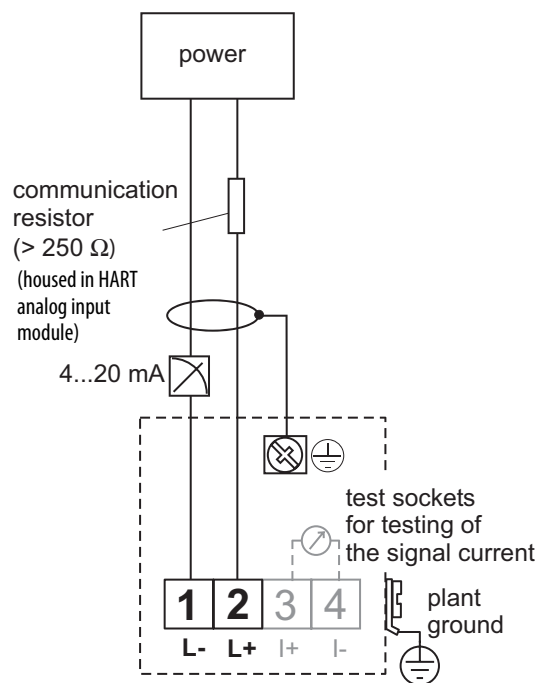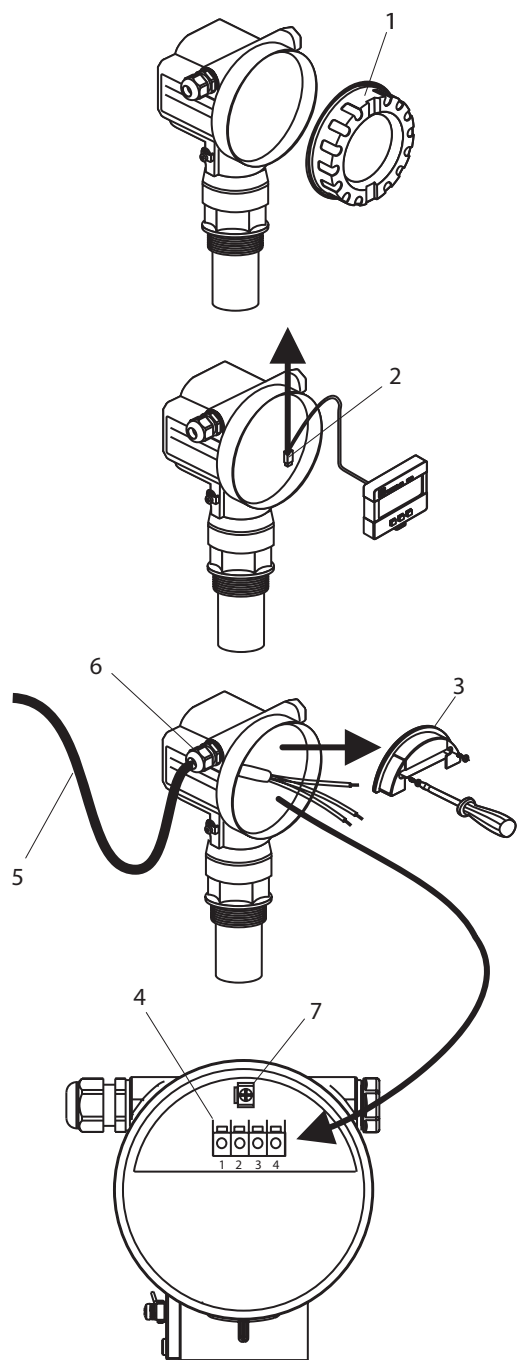
Configure a Prosonic M Ultrasonic Level

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

⚠ Contrast: [E] + [+] or [E] + [−]

| 000 measured value |
| Group selection |

| 008 dist./ meas value |

00 basic setup	002 tank shape	003 medium property	004 process cond.	005 empty calibr.	059 blocking distance	006 full calibr.	008 dist./ meas value	051 check distance	052 range of mapping	053 start mapping
01 safety settings	- dome ceiling	- unknown	- standard	input E (s. sketch)	BD is displayed (s. sketch)	input F (s. sketch)	D and L are displayed (s. sketch)	- ok	confirm suggestion or specify range	
0E temperature	- horizontal cyl.	- liquid	- calm surface					- too small		
04 linearization	- bypass	- > 4 mm	- add. agitator					- too big		
05 extended calibr.	…	- < 4 mm	…					- unknown		
06 output (HART, FF) profibus param.(PA)								- manual		

| 0E Envelope curve | 0E1 plot settings | 0E2 recording curve |

```
        25dB          09C
   -0.01   2.461m    5.00
```

| 09 display | 092 language | … … |

0A diagnostics	0A0 present error	0A1 previous error	… …	0A3 reset	0A4 unlock parameter	… …
				333 (HART) 33333 (PA,FF)	100 (HART) 2457 (PA,FF)	

| 0C system parameter | 0C0 tag no. | … … |

BD: blocking distance

Notes:

Appendix **F**

Levelflex M Guided Radar Level

Topic	Page
Connect a Levelflex M Guided Level-Radar	105
Configure a Levelflex M Guided Level-Radar	106

Component	Cat. No.	Details
Levelflex M guided level-radar	FMP40-APR2CNJB21CA	Firmware revision 1.04

Levelflex instruments are 'downward-looking' measuring systems that function according to the time-of-flight method. The distance from the reference point (process connection of the measuring device) to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information. This method is also known as TDR (Time Domain Reflectometry).

Levelflex provides continuous level measurement of powdery to granular bulk solids, for example, plastic granulate, and liquids. In addition, the Smart Transmitter offers continuous measurement of interfaces between two liquids with different dielectric constants, such as in the case of oil and water.

- Measurement independent of density or bulk weight, conductivity, dielectric constant, temperature, and dust during pneumatic filling.
- Measurement is also possible in the event of foam or if the surface is turbulent.
- Measurement independent of density, conductivity, and temperature.
- Electronics version for the simultaneous measurement of the level of interfaces and the total level in liquids.
- Special version for the measurement of the level of interfaces at a constant total level.
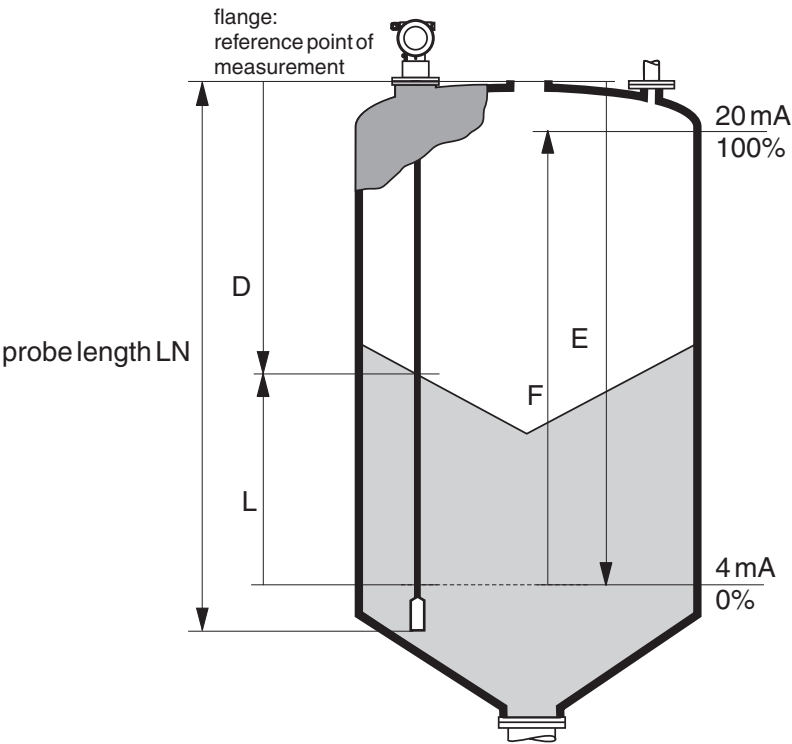
Item	Description
E	Empty distance
F	Span (full distance)
D	Distance from sensor membrane - product surface
L	Level

The dielectric constant (DK) of the medium has a direct impact on the degree of reflection of the high frequency pulses. For large DK values, such as for water or ammonia, there is strong pulse reflection. For low DK values, such as for hydrocarbons, weak pulse reflection is experienced.

Measured Variables

The measured variable is the distance between a reference point and a reflective surface (for example, medium surface). The level is calculated based on the tank height entered. The level can be converted into other units (volume, mass) with a linearization (32 points).

Signals from Instrument to Control System

Signal	Details
Current Output	4...20 mA with HART protocol

Connect a Levelflex M Guided Level-Radar

Use a 2-wire connection to the HART input module.

1. Unscrew housing cover (2).

2. Remove any display (3), if fitted.

3. Remove cover plate from terminal compartment (4).

4. Pull out terminal module slightly by using a 'pulling loop' (only 2-wire).

5. Insert a cable (5) through the gland (6). A standard installation cable is sufficient if the analog signal only is used. Use a screened cable when working with a superimposed communications signal (HART).

6. Only ground screening of the line (7) on sensor side.
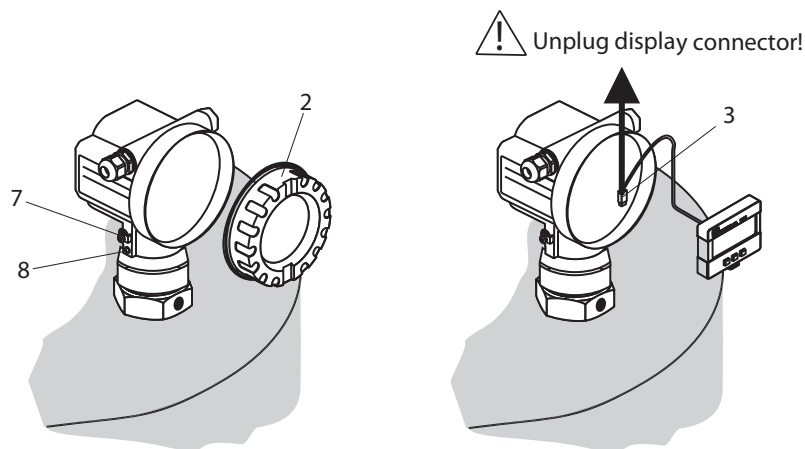
7. Make connection (see pin assignment).

8. Reinsert the terminal module.

9. Tighten cable gland (6). Max. torque 10...12 N•m.

10. Tighten screws on cover plate (4).

11. Insert display, if fitted.

12. Screw on housing cover (2) (ondust-Ex torque 40 N•m).

13. Switch on power supply.
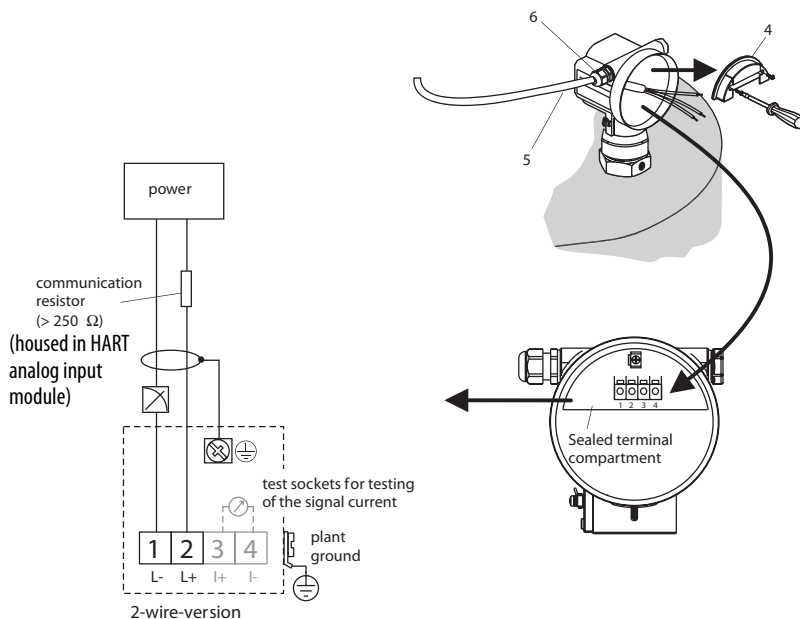
Configure a Levelflex M Guided Level-Radar

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.
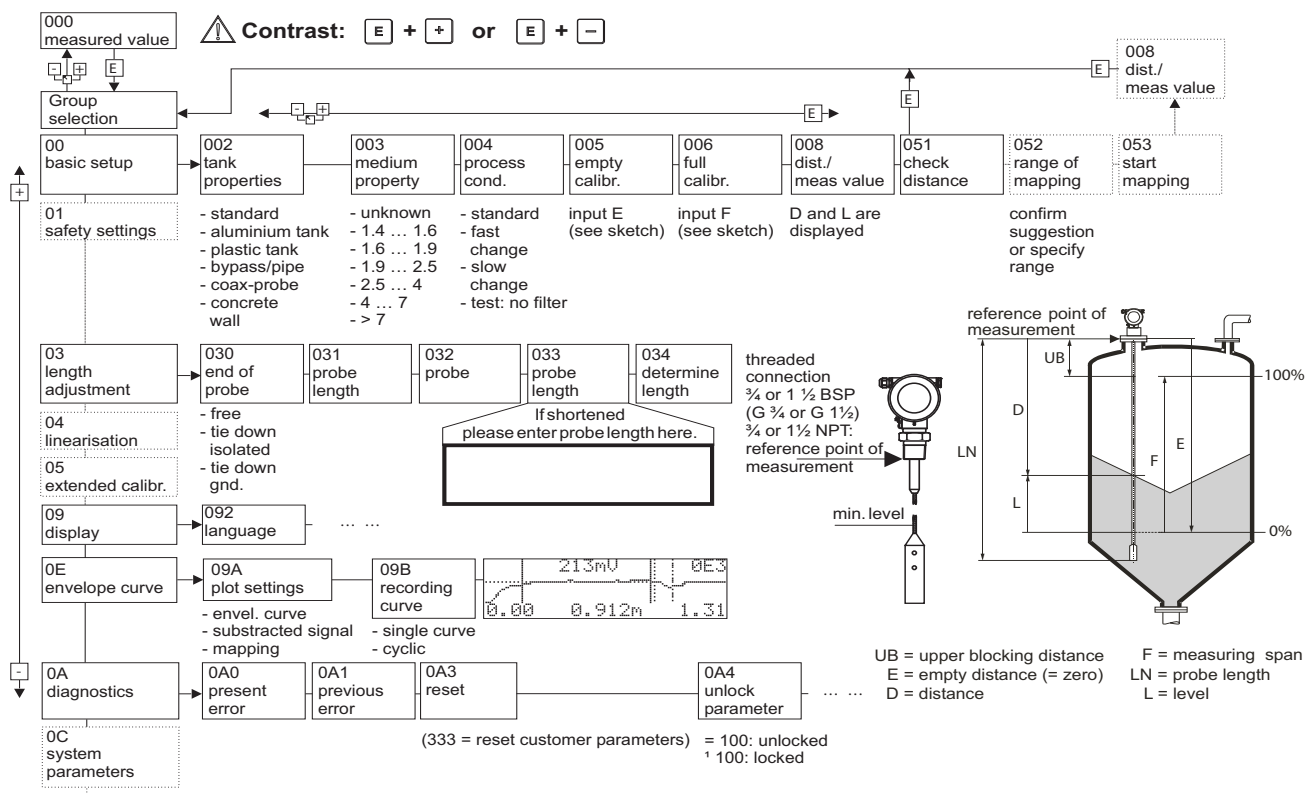
Micropilot M Radar Level

Topic	Page
Connect a Micropilot M Level-Radar	109
Configure a Micropilot M Level-Radar	110

Component	Cat. No.	Details
Micropilot M level-radar	FMR240-A2V1GNJAA4A	Firmware revision 01.05

The Micropilot is a 'downward-looking' measuring system, operating based on the time-of-flight method. It measures the distance from the reference point (process connection) to the product surface. Radar impulses are emitted by an antenna, reflected off the product surface and received again by the radar system.

The Micropilot M is used for continuous, non-contact level measurement of liquids, pastes, slurries, and solids. The measurement is not affected by changing media, temperature changes, gas blankets, or vapors.

Your benefits:

- 2-wire technology, low price:

  A real alternative to differential pressure, floats, and displacers. Two-wire technology reduces wiring costs and eases implementation into existing systems.

- High temperatures:

  Suitable for process temperatures up to 200 °C (392 °F), up to 400 °C (752 °F) with high temperature antenna.

- Rod antenna with inactive length:

  Reliable measurement in narrow nozzles, with condensation and build-up in the nozzle.
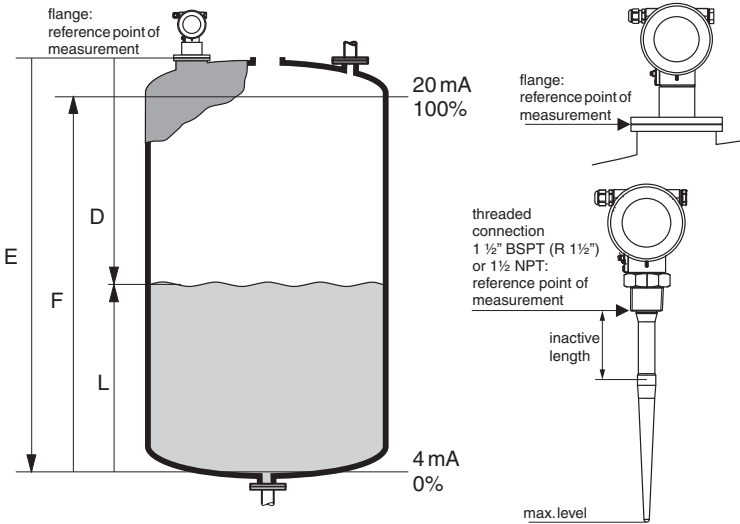
Item	Description
E	Empty distance
F	Span (full distance)
D	Distance from sensor membrane - product surface
L	Level

Measured Variables

The measured variable is the distance between a reference point and a reflective surface (for example, medium surface). The level is calculated based on the tank height entered. The level can be converted into other units (volume, mass) by means of a linearization (32 points).

Signals from Instrument to Control System

Signal	Details
Current Output	4...20 mA with HART protocol

Connect a Micropilot M Level-Radar

Use a 2-wire connection to the HART input module.

1. Unscrew housing cover (2).

2. Remove any display (3), if fitted.

3. Remove cover plate from terminal compartment (4).

4. Pull out the terminal module slightly by using a pulling loop.

5. Insert a cable (5) through the gland (6).

   A standard installation cable is sufficient if the analog signal only is used. Use a screened cable when working with a superimposed communications signal (HART).

⚠ Unplug display connector!
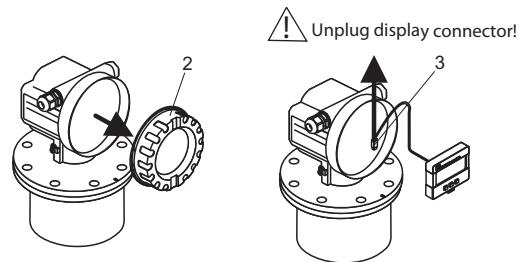
6. Only ground screening of the line (7) on sensor side.

7. Make connection (see pin assignment).

8. Re-insert terminal module.

9. Tighten cable gland (6).

10. Tighten screws on cover plate (4).

11. Insert display, if fitted.

12. Screw on housing cover (2).

13. Switch on power supply.
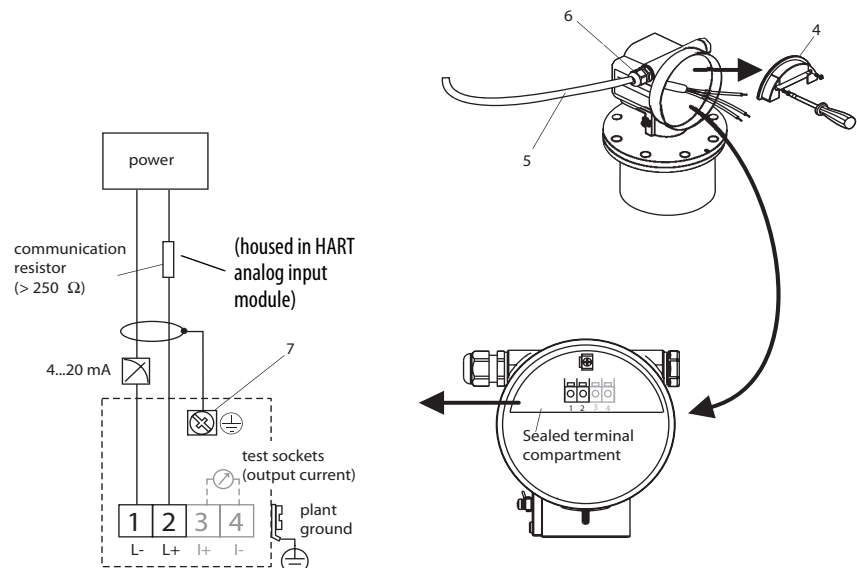
Configure a Micropilot M Level-Radar

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Contrast: E + +   or   E + −

Valid as of software version 01.05.00
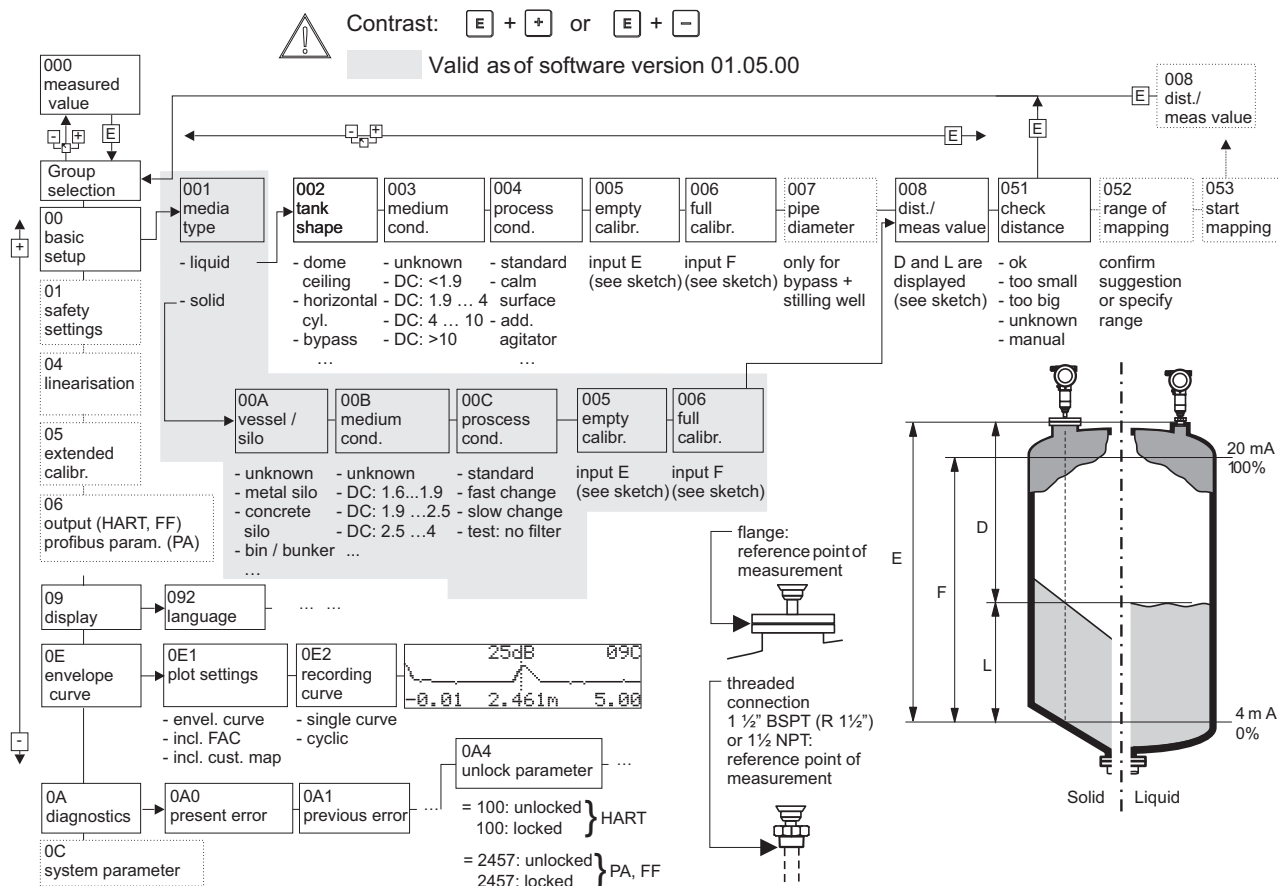
Cerabar S Pressure Transmitter

Topic	Page
Connect a Cerabar S Pressure Transmitter	114
Configure a Cerabar S Pressure Transmitter	115

Component	Cat. No.	Details
Cerabar S pressure transmitter	PMC71-AAC2K6RAANA	Firmware revision 2.10

The Cerabar S pressure transmitter is used for the following measuring tasks:

- Absolute pressure and gauge pressure in gases, steams, or liquids in all areas of process engineering and process measurement technology
- Level, volume, or mass measurement in liquids
- High process temperature
  - without diaphragm seals up to 150 °C (302 °F)
  - with typical diaphragm seals up to 400 °C (752 °F)
- High pressure up to 700 bar
- International usage thanks to a wide range of approvals

Benefits include the following:

- High reference accuracy: up to ±0.075%, as PLATINUM version: ±0.05%
- Turn down 100:1, higher on request
- Used for process pressure monitoring up to SIL3, certified according to IEC 61508 by TÜV SÜD
- HistoROM®/M-DAT memory module
- Continuous modularity for differential pressure, hydrostatic, and pressure (for example, Deltabar S – Deltapilot S – Cerabar S)
  - replaceable display
  - universal electronics
- Extensive diagnostic functions
- Device versions in conformity with ASME-BPE
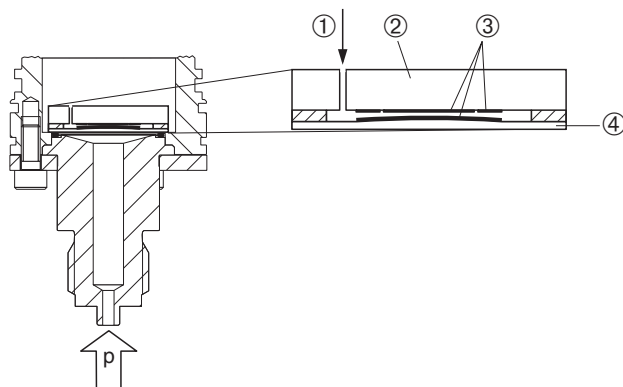
Item	Description
1	Atmospheric vent (gauge pressure only)
2	Ceramic substrate
3	Electrodes
4	Ceramic diaphragm

A ceramic measuring diaphragm is used for the Cerabar S PMC71 (Ceraphire®). The ceramic sensor is a dry sensor, such that the process pressure acts directly on the robust ceramic diaphragm and deflects it. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic carrier and the diaphragm. The measuring range is determined by the thickness of the ceramic diaphragm.

Advantages include the following:

- Guaranteed overload resistance up to 40 times the nominal pressure
- Thanks to highly pure 99.9% ceramic (Ceraphire®, see also www.endress.com/ceraphire)
  - extremely high chemical resistance compared to Alloy
  - less relaxation
  - high mechanical stability
- Suitable for vacuums
- Second process barrier (Secondary Containment) for enhanced integrity
- Process temperature up to 150°C (302°F)

$$h = \frac{p}{\rho \cdot g}$$
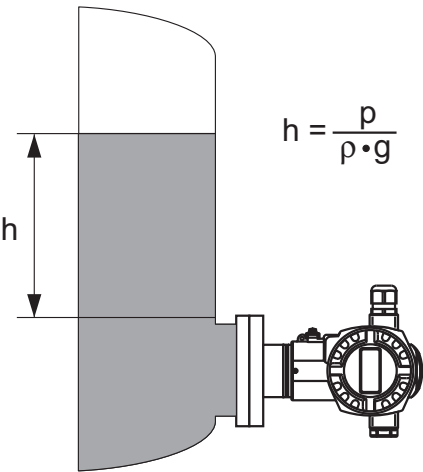
Item	Description
h	Height (level)
p	Pressure
r	Density of the medium
g	Gravitation constant

Measured Variables

Absolute pressure and gauge pressure, from which level (level, volume, or mass) is derived.

Signals from Instrument to Control System

Signal	Details
Output Signal	4...20mA with superimposed digital communication protocol HART 5.0, 2-wire Options: • Maximum alarm: can be set from 21...23 mA • Keep measured value: last measured value is kept • Minimum alarm: 3.6 mA

Connect a Cerabar S Pressure Transmitter

Use a 2-wire connection to the HART input module.

IMPORTANT	The supply voltage must match the supply voltage on the nameplate.

1. Switch off the supply voltage before connecting the device.

2. Remove housing cover of the terminal compartment.

3. Guide cable through the gland. Preferably use twisted, screened two-wire cable.

4. Connect device in accordance with the following diagram.

5. Screw down housing cover.

6. Switch on supply voltage.

Item	Description
1	Housing
2	Jumper for 4…20 mA test signal
3	Internal earth terminal
4	External earth terminal
5	4…20 mA test signal between plus and test terminal
6	Minimum supply voltage = 10.5V DC, jumper is inserted in accordance with the illustration
7	Minimum supply voltage = 11.5V DC, jumper is inserted in 'Test' position
8	Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here

Configure a Cerabar S Pressure Transmitter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Pressure Measuring Mode

```
Measured value
      │
      ▼       1)
GROUP SELECTION
      │
  ┌───┼──────────────┬──────────────┬──────────────┐
  ▼ 1)              ▼ 1)            ▼              ▼
LANGUAGE        MEASURING MODE   QUICK SETUP   OPERATING MENU
                                    │
                                    ▼   2)
                              MEASURING MODE
                                    │
                          Pressure ─┴─ Level
                                    │
   Gauge pressure sensors ──────────┼────────── Absolute pressure sensors
                              ▼              ▼
                      POS . ZERO ADJUST   POS . INPUT VALUE
                                    │
                                    ▼
                                 SET LRV
                                    │
                                    ▼
                                 SET URV
                                    │
                                    ▼
                             DAMPING VALUE
```

1) Display via on-site display only

2) Display via FieldCare and HART handheld terminal only

Level Measuring Mode

```
Measured value
      │
      ▼       1)
GROUP SELECTION
      │
  ┌───┼──────────────┬──────────────┬──────────────┐
  ▼ 1)              ▼ 1)            ▼              ▼
LANGUAGE        MEASURING MODE   QUICK SETUP   OPERATING MENU
                                    │
                                    ▼   2)
                              MEASURING MODE
                                    │
                          Pressure ─┴─ Level
                                    │
   Gauge pressure sensors ──────────┼────────── Absolute pressure sensors
                              ▼              ▼
                      POS . ZERO ADJUST   POS . INPUT VALUE
                                    │
                                    ▼
                                 SET LRV
                                    │
                                    ▼
                                 SET URV
                                    │
                                    ▼
                             DAMPING VALUE
```

1) Display via on-site display only

2) Display via FieldCare and HART handheld terminal only

Notes:

Deltabar S Differential Pressure

Topic	Page
Connect a Deltabar S Differential Pressure	121
Configure a Deltabar S Differential Pressure	122

Component	Cat. No.	Details
Deltabar S Differential pressure transmitter	PMD75-AAC7F41BAAA	Firmware revision 2.10

The Deltabar S differential pressure transmitter is used for the following measuring tasks:

- Flow measurement (volume or mass flow) in conjunction with primary elements in gases, vapors, and liquids
- Level, volume, or mass measurement in liquids
- Differential pressure monitoring, for example, filters and pumps
- International usage from a wide range of approvals

Benefits include the following:

- Good reproducibility and long-term stability
- High reference accuracy: up to ±0.075%, as PLATINUM version: ±0.05%
- Turn down 100:1, higher on request
- Used for flow and differential pressure monitoring up to SIL 3, certified to IEC 61508 by TÜV SÜD
- HistoROM®/M-DAT memory module
- Function-monitored from the measuring cell to the electronics
- Continuous modularity for differential pressure, hydrostatic, and pressure (Deltabar S, Deltapilot S, Cerabar S).
  - Replaceable display
  - Universal electronics for pressure and differential pressure
- Extensive diagnostic functions
- Choice of four flow modes of operation: volume flow, norm volume flow (European norm conditions), standard volume flow (American standard conditions), and mass flow

Metal Measuring Cell

Metallic measuring diaphragms are used for the Deltabar S PMD75. The separating diaphragms (3/9) are deflected on both sides by the acting pressures. A filling oil (4/8) transfers the pressure to a resistance circuit bridge (semi-conductor technology). The differential-pressure-dependent change of the bridge output voltage is measured and further processed.

The following is an example of metal measuring cell 10 mbar and 30 mbar.
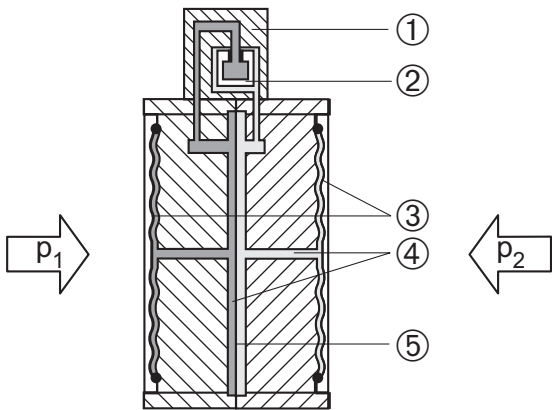
Item	Description
1	Sensing element
2	Silicon diaphragm
3	Separating diaphragm
4	Filling oil
5	Integrated overload protection

The following is an example of metal measuring cell as of 100 mbar.
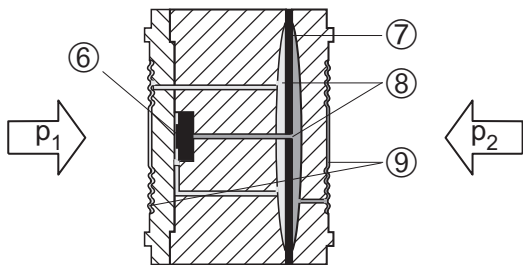
Item	Description
6	Sensing element
7	Overload diaphragm/Middle diaphragm
8	Filling Oil

Advantages:

- Standard operating pressures: 160 bar and 420 bar
- High long-term stability
- Very high single-sided overload resistance
- Second process barrier (Secondary Containment) for enhanced integrity

The following is an example of flow measurement with Deltabar S and primary element. The left is the Orifice place and the right is the Pitot tube.
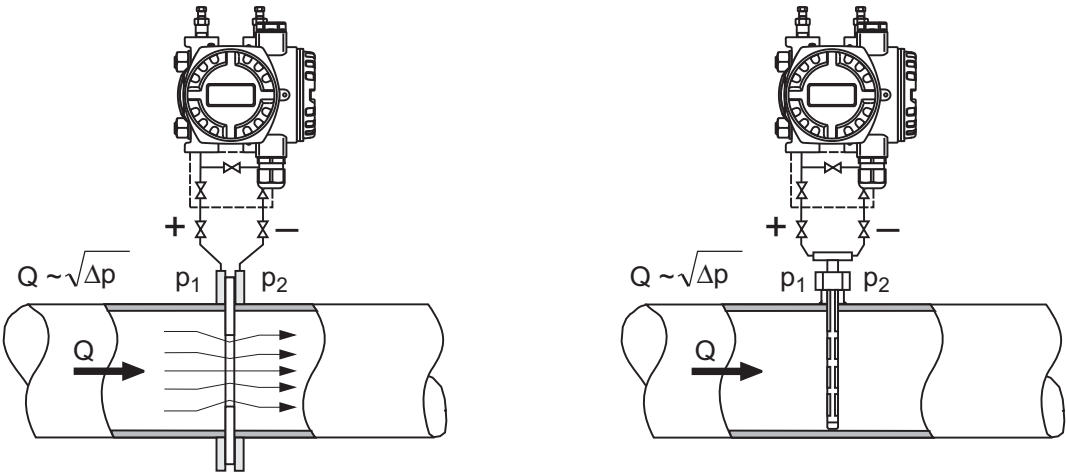
Item	Description
Q	Flow
p	Differential pressure, p = p1 - p2

This example shows the level measurement with Deltabar S.

$$h = \frac{\Delta p}{\rho \cdot g}$$
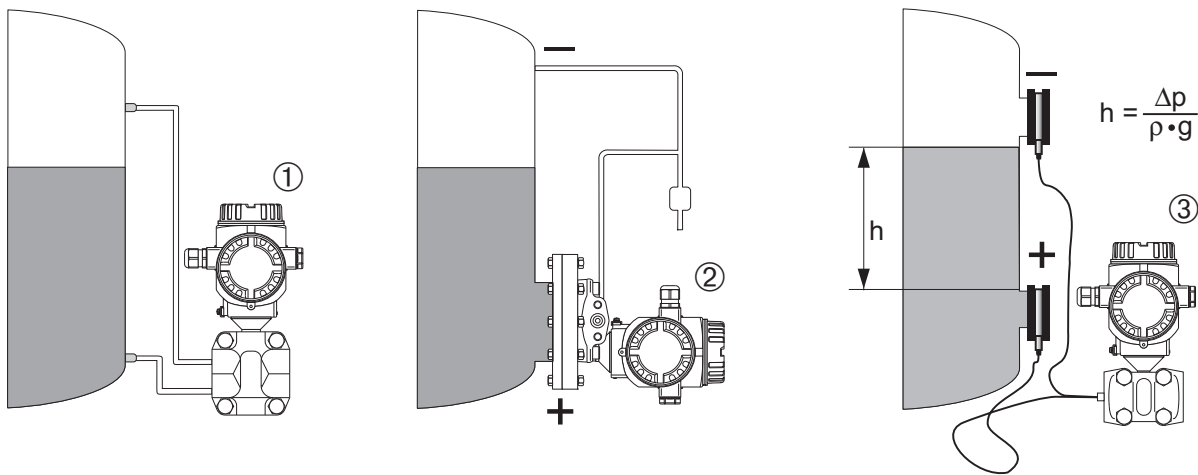
Item	Description
1	Level measurement via impulse piping and PMD70
2	Level measurement with FMD76
3	Level measurement with FMD78
h	Height (level)
p	Differential pressure Density of the medium
g	Gravitation constant

Measured Variable

Differential pressure, from which flow (volume or mass current) and level (level, volume or mass) are derived.

Signals from Instrument to Control System

Signal	Details
Output signal	4...20 mA with superimposed digital communication protocol HART 5.0, 2-wire
Signal range	4...20 mA HART 3.8 mA…20.5 mA
Signal on alarm	4...20 mA HART Options • Maximum alarm*: can be set from 21...23 mA • Keep measured value: last measured value is kept • Minimum alarm: 3.6 mA *Factory setting: 22 mA

Connect a Deltabar S Differential Pressure

Use a 2-wire connection to the HART input module.

IMPORTANT	The supply voltage must match the supply voltage on the nameplate.

1. Switch off the supply voltage before connecting the device.

2. Remove housing cover of the terminal compartment.

3. Guide cable through the gland. Preferably use twisted, screened two-wire cable.

4. Connect device in accordance with the following diagram.

5. Screw down housing cover.

6. Switch on supply voltage.

Item	Description
1	Housing
2	Jumper for 4…20 mA test signal
3	Internal earth terminal
4	External earth terminal
5	4…20 mA test signal between plus and test terminal
6	Minimum supply voltage = 10.5 V DC, jumper is inserted in accordance with the illustration
7	Minimum supply voltage = 11.5 V DC, jumper is inserted in "Test" position
8	Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here

Configure a Deltabar S Differential Pressure

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.
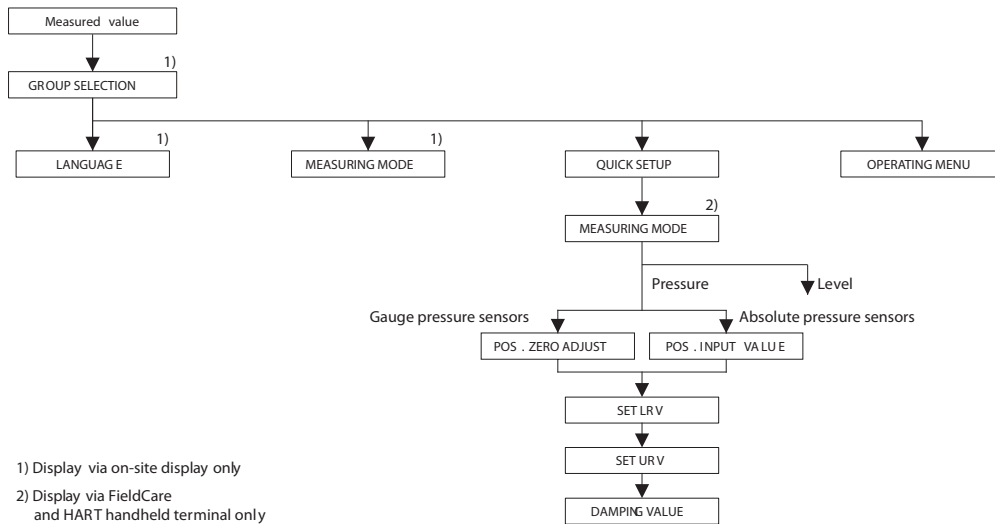
Flow Measuring Mode

```
              Measured value
                    │
                    ▼  1)
            GROUP SELECTION
                    │
        ┌───────────┼───────────────────┬───────────────────┐
        ▼  1)       ▼  1)                ▼                   ▼
    LANGUAGE    MEASURING MODE       QUICK SETUP       OPERATING MENU
                                         │
                                         ▼  2)
                                   MEASURING MODE
                        ┌───────────┬─────────┤
                        ▼           ▼         ▼
                    Pressure      Level      Flow
                                              │
                                              ▼
                                       POS. ZERO ADJUST
                                              │
                                              ▼
                                          MAX FLOW
                                              │
                                              ▼
                                       MAX. PRESS. FLOW
                                              │
                                              ▼
                                       DAMPING VALUE
```

1) Display via on-site display only

2) Display via ToF Tool, FieldCare and HART handheld terminal only

Level Measuring Mode

```
              Measured value
                    │
                    ▼  1)
            GROUP SELECTION
                    │
        ┌───────────┼───────────────────┬───────────────────┐
        ▼  1)       ▼  1)                ▼                   ▼
    LANGUAGE    MEASURING MODE       QUICK SETUP       OPERATING MENU
                    │                    │
                    ▼                    ▼  2)
            LEVEL SELECTION        MEASURING MODE
                        ┌───────────┬─────────┐
                        ▼           ▼         ▼
                    Pressure      Level      Flow
                                    │
                                    ▼
                             LEVEL SELECTION
                                    │
                                    ▼
                             POS. ZERO ADJUST
                                    │
                                    ▼  3)
                              EMPTY CALIB.
                                    │
                                    ▼  3)
                               FULL CALIB.
                                    │
                                    ▼
                              DAMPING VALUE
```

1) Display via on-site display only

2) Display via FieldCare and HART handheld terminal only

3) – LEVEL SELECTION "Level Easy Pressure" and CALIBRATION MODE "Wet"
   – LEVEL SELECTION = "Level Standard", LEVEL MODE = "Linear" and CALIBRATION MODE = "Wet"

Pressure Measuring Mode

```
┌─────────────────┐
│ Measured value  │
└────────┬────────┘
         │              1)
┌────────▼────────┐
│ GROUP SELECTION │
└────────┬────────┘
    ┌─────┬──────────────┬──────────────┬──────────────┐
    ▼ 1)  ▼ 1)           ▼              ▼
┌──────────┐ ┌──────────────┐ ┌─────────────┐ ┌─────────────────┐
│ LANGUAGE │ │MEASURING MODE│ │ QUICK SETUP │ │ OPERATING MENU  │
└──────────┘ └──────────────┘ └──────┬──────┘ └─────────────────┘
                                      ▼ 2)
                              ┌──────────────┐
                              │MEASURING MODE│
                              └──────┬───────┘
                     Pressure ▼  Level ▼   Flow ▼
                          ┌────────────────┐
                          │ POS. ZERO ADJUST│
                          └───────┬────────┘
                          ┌───────▼────────┐
                          │    SET LRV     │
                          └───────┬────────┘
                          ┌───────▼────────┐
                          │    SET URV     │
                          └───────┬────────┘
                          ┌───────▼────────┐
                          │ DAMPING VALUE  │
                          └────────────────┘
```

1) Display via on-site display only
2) Display via FieldCare and
   HART handheld terminal only

Notes:

Prosonic S Transmitter

Topic	Page
Connect a Prosonic S Transmitter	127
Configure a Prosonic S Transmitter	129

Component	Cat. No.	Details
Prosonic S transmitter	FMU90-R11CA111AA1A	Firmware revision 2.00

The Prosonic S transmitter provides non-contact level measurement of fluids, pastes sludge and powdery to coarse bulk materials and flow measurement in open channels and measuring weirs with one or two ultrasonic sensors. Prosonic S offers the following benefits:

- Time-of-flight correction via integrated or external temperature sensors.
- Simultaneous measurement of level and flow in a stormwater overflow basin with only one sensor.
- Pre-programmed pump control routines.
- Automatic detection of the sensors FDU9x.
- The sensors of the former series FDU8x can be connected.
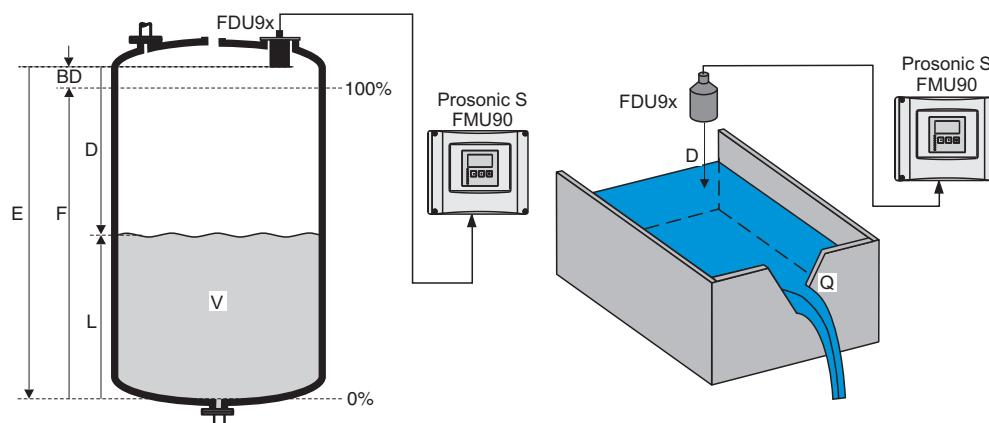
Item	Description
BD	Blocking distance
D	Distance from sensor membrane to fluid surface
E	Empty distance
F	Span (full distance)
L	Level
V	Volume (or mass)
Q	Flow

The sensor transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The transmitter Prosonic S measures the time t between pulse transmission and reception. From (and the velocity of sound 'c') it calculates the distance 'D' from the sensor membrane to the product surface:

$$D = c \cdot t/2$$

Measured Variables

From 'D' results the desired measuring value:

- Level L
- Volume V
- Flow Q across measuring weirs or open channels

Signals from Instrument to Control System

Output Signal	Details
Current Output	4...20 mA with HART 0...20mA without HART USS = 200 mV at 47...125Hz (measured at 500Ω) Ueff = 2,2 mV at 500 Hz... 10 kHz (measured at 500Ω) For Setting 4...20 mA, selectable • 10% (3,6 mA) • 110% (22 mA) • HOLD (last current value is held) • User specific For Setting 0...20 mA • 110% (21,6 mA) • HOLD (last current value is held) • User specific Maximum 600 Ω, influence negligible • USS = 200 mV at 47...125Hz (measured at 500Ω) • Ueff = 2,2 mV at 500 Hz...10kHz (measured at 500Ω)
Output Damping	Freely selectable, 0...1000 s
Relay Outputs	DC voltage: 35V DC, 100 W AC voltage: 4 A, 250V, 100VA at cos = 0.7

Connect a Prosonic S Transmitter

Use a 4-wire connection to the HART input module. Following are the terminals of the Prosonic S. The terminals depicted in grey are not present in every instrument version.
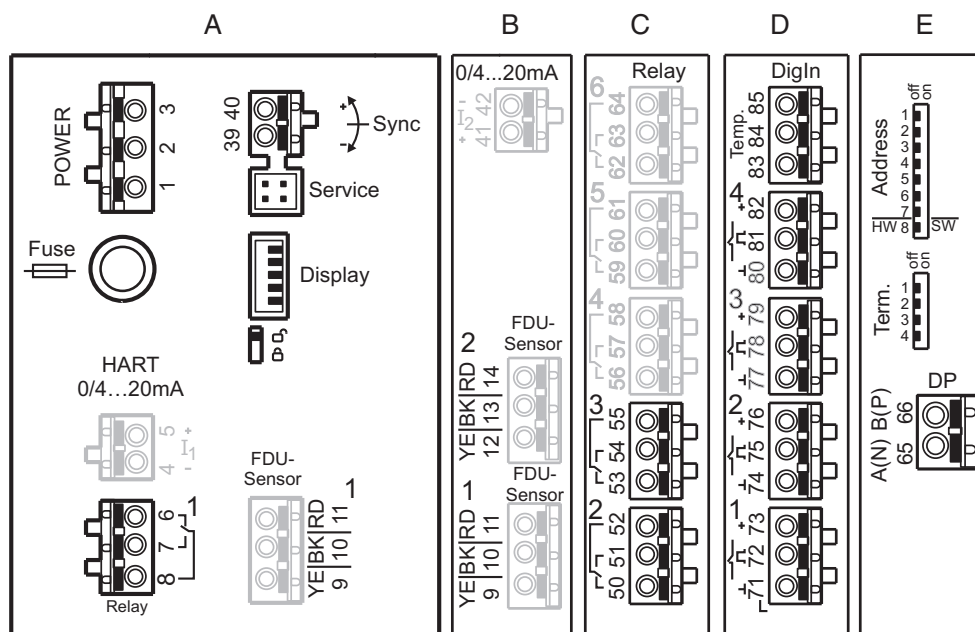
Item	Description
A	Basic terminal area
B...E	Optional terminal areas (present if the respective option has been selected in the product structure)

Sensor Connection

Configure a Prosonic S Transmitter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.
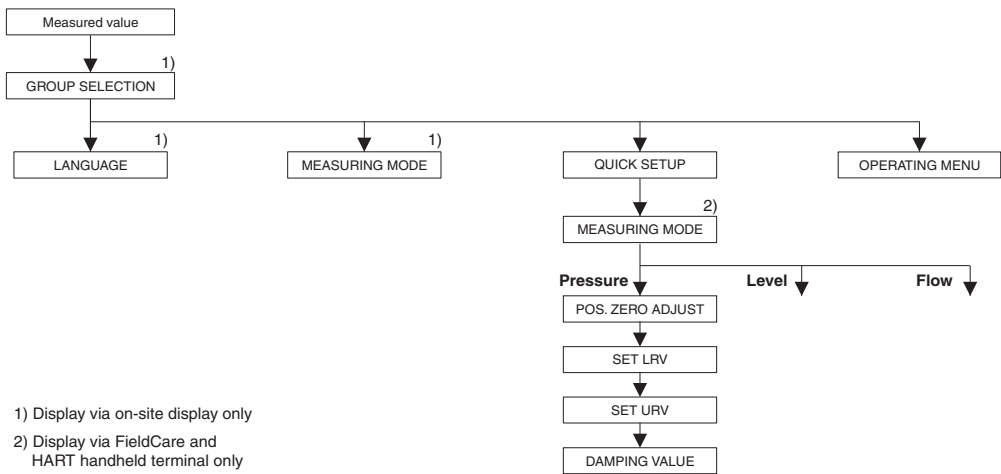
Excerpt from the operating menu.
For the complete menu see the Operating Instructions.

level -> level (LVL1) -> basic setup

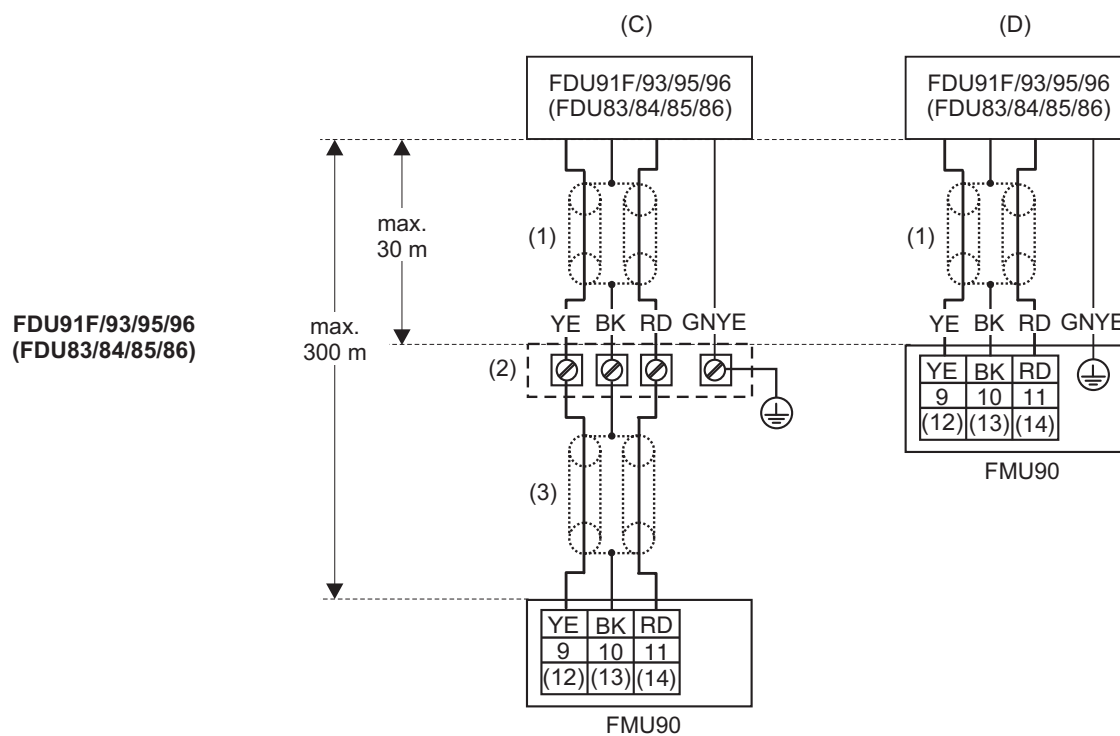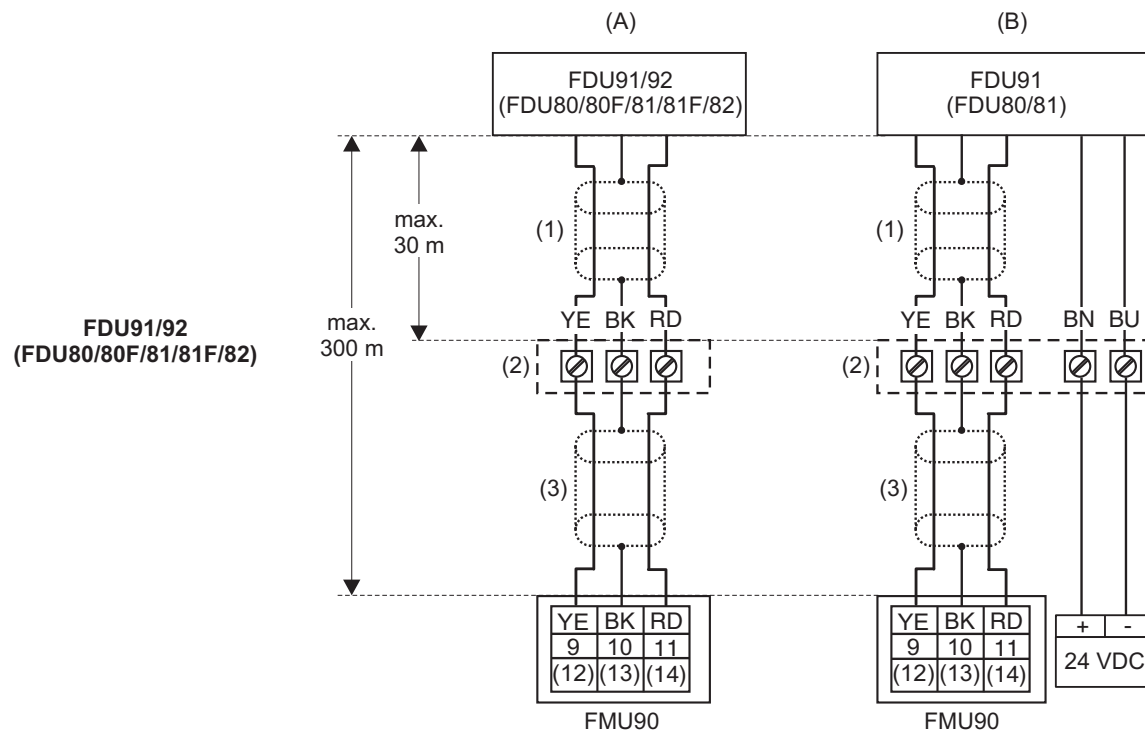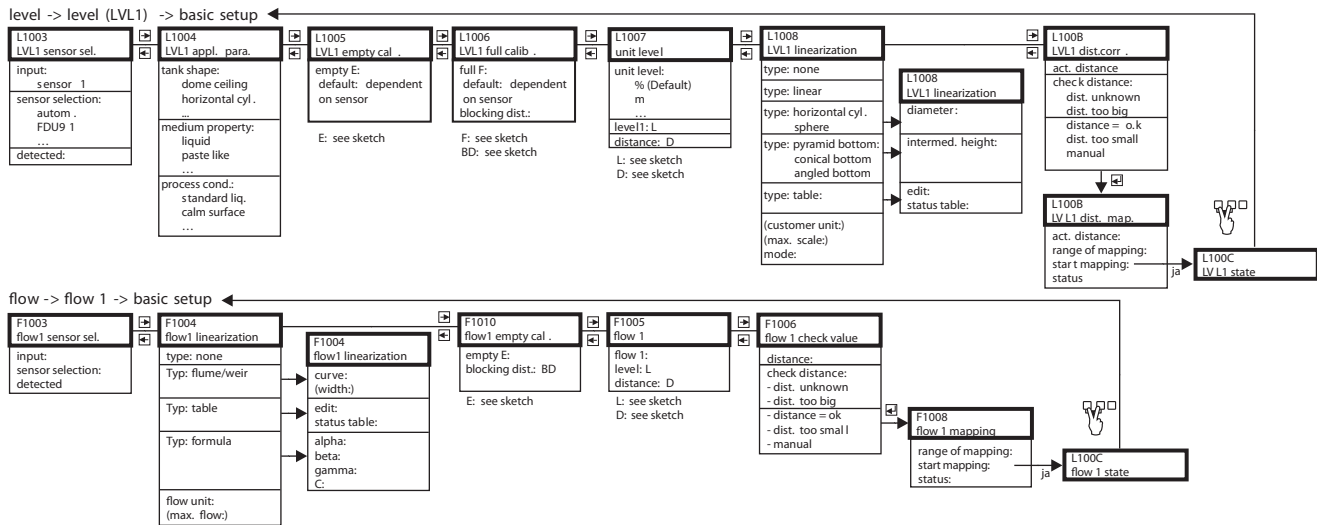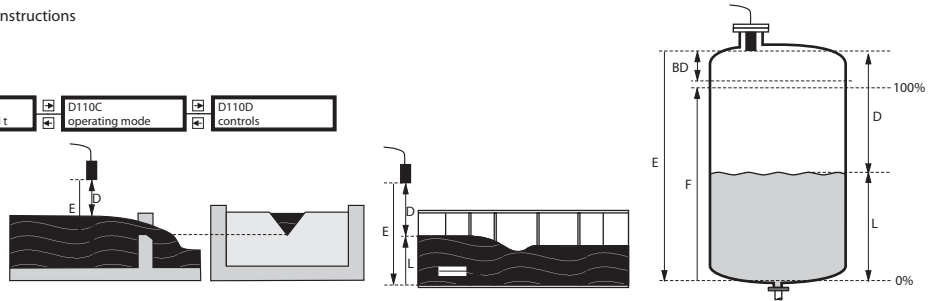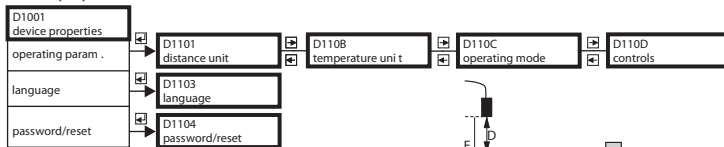| L1003 LVL1 sensor sel.	L1004 LVL1 appl. para.	L1005 LVL1 empty cal .	L1006 LVL1 full calib .	L1007 unit level	L1008 LVL1 linearization	L100B LVL1 dist.corr .

L1003
LVL1 sensor sel.
input:
 sensor   1
sensor selection:
 autom .
 FDU9 1
 …
detected:

L1004
LVL1 appl. para.
tank shape:
 dome ceiling
 horizontal cyl .
 …
medium property:
 liquid
 paste like
 …
process cond.:
 standard liq.
 calm surface
 …

L1005
LVL1 empty cal .
empty E:
 default: dependent
 on sensor

E: see sketch

L1006
LVL1 full calib .
full F:
 default: dependent
 on sensor
blocking dist.:

F: see sketch
BD: see sketch

L1007
unit leve l
unit leve l
 % (Default)
 m
 …
level1: L
distance: D
L: see sketch
D: see sketch

L1008
LVL1 linearization
type: none
type: linear
type: horizontal cyl .
 sphere
type: pyramid bottom:
 conical bottom
 angled bottom
type: table:

(customer unit:)
(max. scale:)
mode:

L1008
LVL1 linearization
diameter :

intermed. height:

edit:
status table:

L100B
LVL1 dist.corr .
act. distance
check distance:
 dist. unknown
 dist. too big
 distance = o.k
 dist. too small
 manual

L100B
LV L1 dist. map.
act. distance:
range of mapping:
star t mapping:
status

L100C
LV L1 state

ja

flow -> flow 1 -> basic setup

F1003 flow1 sensor sel.	F1004 flow1 linearization	F1010 flow1 empty cal .	F1005 flow 1	F1006 flow 1 check value

F1003
flow1 sensor sel.
input:
sensor selection:
detected

F1004
flow1 linearization
type: none
Typ: flume/weir
Typ: table
Typ: formula

flow unit:
(max. flow:)

F1004
flow1 linearization
curve:
 (width:)
edit:
status table:
alpha:
beta:
gamma:
C:

F1010
flow1 empty cal .
empty E:
blocking dist.: BD

E: see sketch

F1005
flow 1:
level: L
distance: D
L: see sketch
D: see sketch

F1006
flow 1 check value
distance:
check distance:
 - dist. unknown
 - dist. too big
 - distance = ok
 - dist. too smal l
 - manual

F1008
flow 1 mapping
range of mapping:
start mapping:
status:

L100C
flow 1 state

ja

relay/control s -> relay configuration -> see Operating Instructions

device propertie s

D1001
device properties
operating param .
language
password/reset

D1101 distance unit	D110B temperature uni t	D110C operating mode	D110D controls

D1103
language

D1104
password/reset

BD
100%
D
E
F
L
0%

Notes:

iTEMP TMT162 Temperature Transmitter

Topic	Page
Connect an iTEMP TMT162 Temperature Transmitter	133
Configure an iTEMP TMT162 Temperature Transmitter	134

| Component	Cat. No.	Details
iTEMP TMT162 temperature transmitter	TMT162R-A4A12N31X0 (X = 80 mm)	Firmware revision 1.03

The iTEMP temperature field transmitter TMT162 has these characteristics:
- 2-wire transmitter with analog output or fieldbus protocol
- 2 (optional) measuring inputs for resistance thermometers
- Resistance transmitters in 2-wire, 3-wire, or 4-wire connection, thermocouples, and voltage transmitters.

The LC display shows the current measured value digitally and as a bar graph with an indicator for alarms.

Features and benefits include the following:
- Highest reliability in harsh industrial environments due to dual compartment housing and compact fully potted electronics
- Blue backlit display with large measured value, bar graph, and fault condition indication for ease of reading
- Ability to display parameters of up to four other devices
- Dual sensor input capability, for example, 2 Pt100 3-wire or 1 Pt100 4-wire & TC
- Minimum and maximum process value recorded
- Sensor monitoring: Breakdown information, sensor backup, drift alarm, and corrosion detection avoids shutdown and enables a quick maintenance intervention
- Sensor matching: Linearization with Callendar van Dusen or polynomial - equation to provide for optimal accuracy of the temperature measurement
- Operation voltage monitoring for highest measurement reliability (HART)
- Mathematic functions for differential and average temperature add flexibility to the measurement
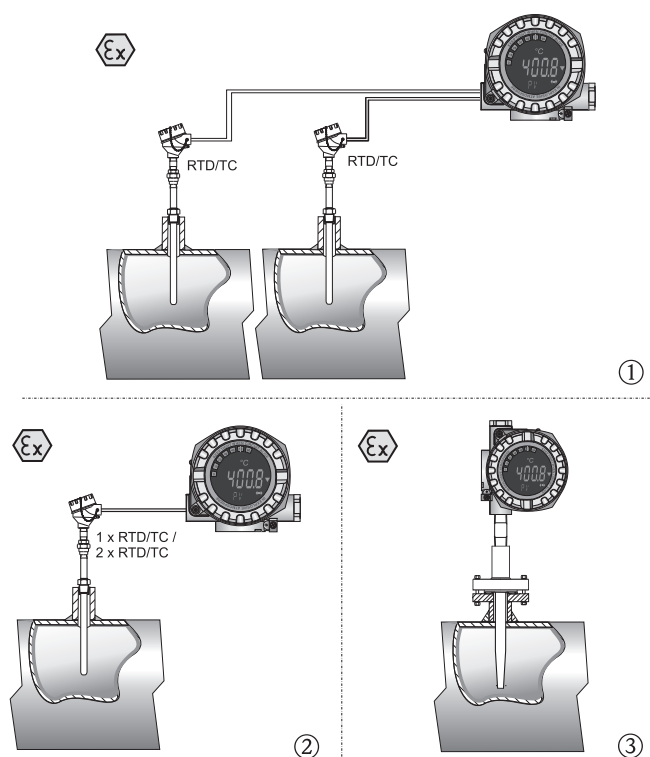
Corrosion of the sensor connections can lead to corruption of the measured value. The field transmitter, therefore, offers the option of detecting corrosion on the thermocouples and resistance thermometers with a 4-wire connection before measured value corruption occurs. The transmitter avoids false measured readings and is also able to indicate a warning on the display as well as through HART or FOUNDATION Fieldbus protocol when wire resistance is exceeding reasonable values.

Measured Variables

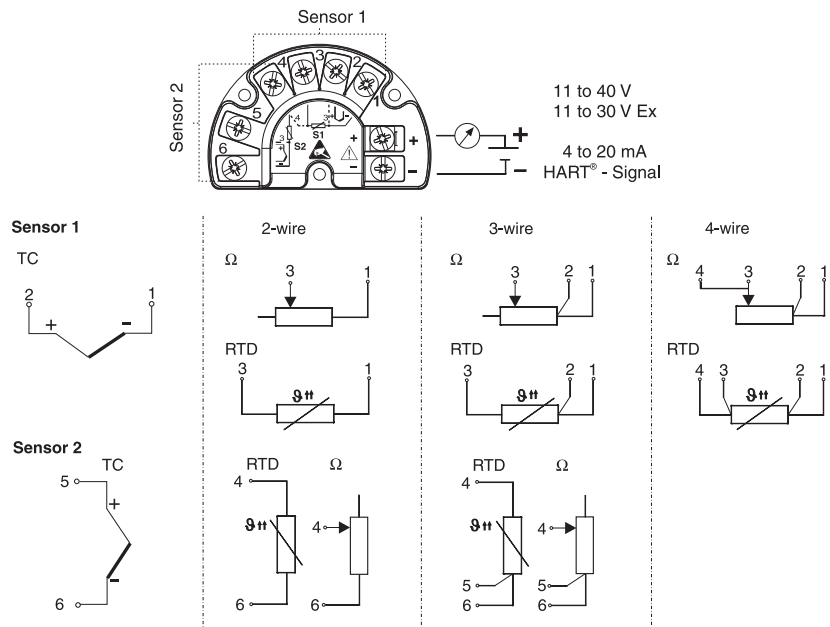Temperature (temperature linear transmission behavior), resistance, and voltage.

Signals from Instrument to Control System

Signal	Details
Output Signal	Analog 4…20 mA, 20…2 mA
Load	HART Max. (VPower Supply - 11V) / 0.022 A (current output)
Galvanic Isolation	U = 2 kV AC (input/output)
Switch On Delay	4 s, during switch-on operation Ia ≤ 3.8 mA (HART)
Perm. Residual ripple	Uss ≤ 3V at Ub ≥ 13.5V, fmax. = 1 kHz

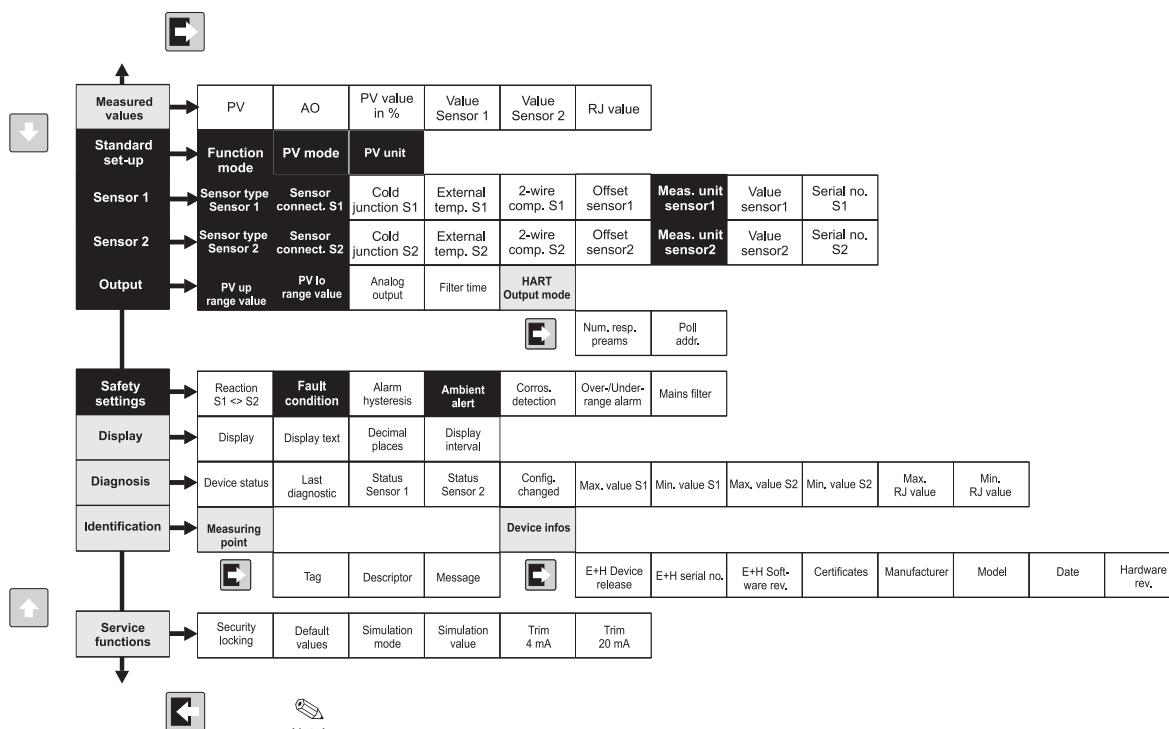# Connect an iTEMP TMT162 Temperature Transmitter

Use a 2-wire connection to the HART input module.

1. Open the conduit entry of the device.

2. Feed the leads through the opening in the cable gland or through the conduit entry.

3. Connect the leads as shown in the figure.

4. Make sure that the terminal screws are tight. Reseal the cable gland or conduit by screwing the cover back on.

5. To avoid connection errors, take note of the hints that are given in the section Connection Check in the operating manual.

Configure an iTEMP TMT162 Temperature Transmitter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Measured values	PV	AO	PV value in %	Value Sensor 1	Value Sensor 2	RJ value			
Standard set-up	Function mode	PV mode	PV unit						
Sensor 1	Sensor type Sensor 1	Sensor connect. S1	Cold junction S1	External temp. S1	2-wire comp. S1	Offset sensor1	Meas. unit sensor1	Value sensor1	Serial no. S1
Sensor 2	Sensor type Sensor 2	Sensor connect. S2	Cold junction S2	External temp. S2	2-wire comp. S2	Offset sensor2	Meas. unit sensor2	Value sensor2	Serial no. S2
Output	PV up range value	PV lo range value	Analog output	Filter time	HART Output mode				

	Num. resp. preams	Poll addr.

Safety settings	Reaction S1 <> S2	Fault condition	Alarm hysteresis	Ambient alert	Corros. detection	Over-/Under- range alarm	Mains filter				
Display	Display	Display text	Decimal places	Display interval							
Diagnosis	Device status	Last diagnostic	Status Sensor 1	Status Sensor 2	Config. changed	Max. value S1	Min. value S1	Max. value S2	Min. value S2	Max. RJ value	Min. RJ value
Identification	Measuring point			Device infos							

	Tag	Descriptor	Message		E+H Device release	E+H serial no.	E+H Soft-ware rev.	Certificates	Manufacturer	Model	Date	Hardware rev.

Service functions	Security locking	Default values	Simulation mode	Simulation value	Trim 4 mA	Trim 20 mA

Note!
The black highlighted function fields are marking the Quick Setup menu.

iTEMP TMT182 Temperature Transmitter

Topic	Page
Connect an iTEMP TMT182 Temperature Transmitter	136
Configure an iTEMP TMT182 Temperature Transmitter	137

Component	Cat. No.	Details
iTEMP TMT182 temperature head transmitter	TMT182-CAAAA	Firmware revision 1.01

The iTEMP TMT182 temperature head transmitter is a 2-wire transmitter that converts various input signals into a scalable 4...20 mA analog output signal. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connections, thermocouples, and voltage transmitters.

Benefits include the following:

- Universal settings with HART protocol for various input signals
- 2-wire technology, 4...20 mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit, can be preset to NAMUR NE 43
- Output simulation
- Minimum/maximum process value indicator function
- Customer specific linearization
- Linearization curve match
- Customer-specific measurement range settings or expanded set up

Measured Variables

Temperature (temperature linear transmission behavior), resistance, and voltage.

Signals from Instrument to Control System

Signal	Details
Output Signal	Analog 4...20mA, 20...4mA
Load	Max (VPower supply - 11.5V) / 0.022 A (current output)
Switch on Delay	4 s (during Power up la - 3.8 mA)
Galvanic Isolation	U = 2 kV AC (input/output)

Signal on Alarm	• Underranging:
	  Linear drop to 3.8 mA
	• Overranging:
	  Linear rise to 20.5 mA
	• Sensor break; sensor short-circuit (not for thermocouples TC):
	  3.6 mA or 21.0 mA
	  Failure signal 21.0 mA; if output setting is 21.0 mA, > 21.5 mA is guaranteed

Allowable Ripple	Uss $\leq$ 3 V at Ub $\geq$ 13 V, fmax. = 1 kHz

Connect an iTEMP TMT182 Temperature Transmitter

Use a 2-wire connection to the HART input module.

Configure an iTEMP TMT182 Temperature Transmitter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Working parameters	PV	Int. temperature	Filter time	RJ mode	RJ external value	Bias input			
Calibration	Sensor input	Measuring unit	Direction output	Min measurm range	Max measurm range	RTD connection	RTD 2 wire comp.	Sensor error	User linearisation
Service	Error code	Last diagnostic	Min Indication	Max Indication	Default values	Simulation mode	Simulation value	Security locking	Config changed
	Tag number	Descriptor	Message	Date	Serial No	Dev Id	Software rev	Product revision	Universal rev	Hardware rev
	Poll addr	Num resp preams	Burst mode	Burst option					

Matrix parameter / Device data / HART Output / PV / AO

Coefficient X0
Coefficient X1
Coefficient X2
Coefficient X3
Coefficient X4

Note!
The black highlighted function fields are marking the Quick Setup menu.

Notes:

Liquiline M CM42 Transmitter

Topic	Page
Connect a Liquiline M CM42 Transmitter	142
Configure a Liquiline M CM42 Transmitter	148

Component	Cat. No.	Details
Liquiline M CM42 Transmitter	CM42-MAA001EAS00	Firmware revision 10.04

Liquiline M CM42 is a modular 2-wire transmitter for all areas of process engineering. Depending on the ordered version, Liquiline has one or two analog current outputs or it can be connected to field buses. Liquiline is developed according to the international safety standard IEC 61508.

The extremely robust, corrosion-resistant plastic version, and the hygienic, stainless steel version are designed for the following applications:

- Chemical processes
- Pharmaceuticals industry
- Foodstuff technology
- Applications in hazardous locations

Measuring System Examples
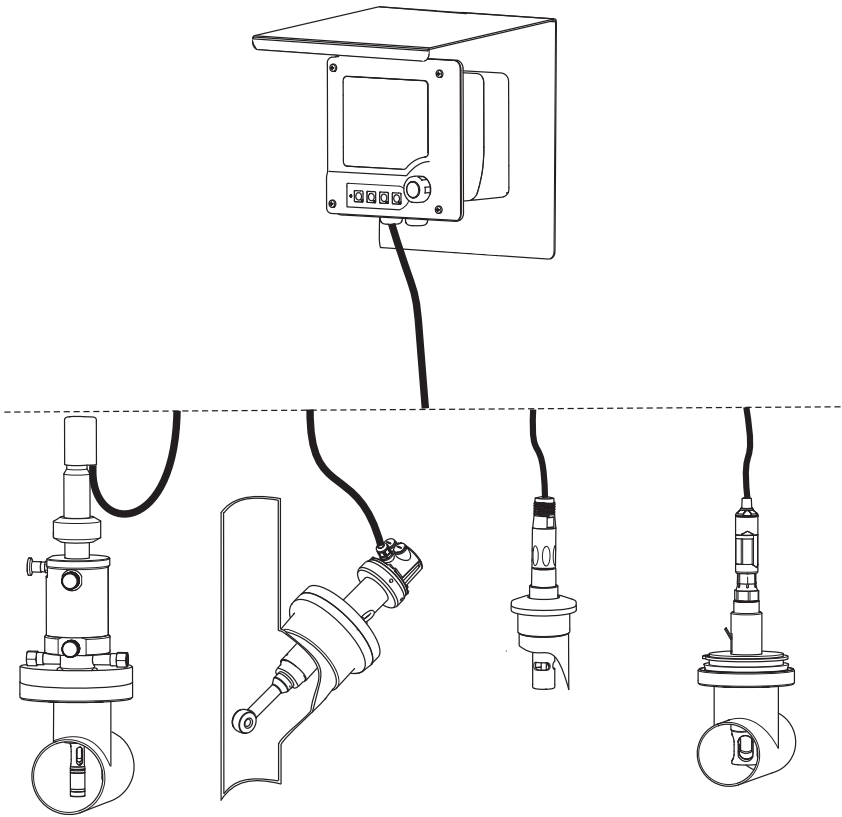
pH/ORP	Conductivity, Inductive Measurement	Conductivity, Conductive Measurement	Digital Sensor
• CM42-P/R... • Measuring cable CPK9 • Assembly Cleanfit CPA471 • Sensor Orbisint CPS11	• CM42-I... • Assembly Dipfit CLA111	• CM420C... • Measuring cable CPK9 • Sensor Condumax CLS16	• CM42-M/N/0 • Measuring cable CYK10 • Assembly Unifit CPA442 • Sensor CPS11D (pH: glass)/CPS471D (pH: ISFET)/COS21D (oxygen)

Measured Variables

pH/ORP (analog sensors)

- pH value
- Oxidation-reduction potential (ORP)
- Temperature

Conductivity (analog sensors)

- Conductivity
- Resistivity (conductive measurement only)
- Concentration

pH/ORP (digital sensors)

Oxygen (digital sensors)

- pH value
- Oxidation-reduction potential
- Oxygen
- Temperature

Signals from Instrument to Control System

Signal	Details	

Output signal	Max load with a supply voltage of 24V: 500 Ω
	Max load with a supply voltage of 30V: 750 Ω
	• Current output 1:
	  1x 4...20 mA, potentially isolated against sensor circuit
	• Current output 1 and current output 2 (optional):
	  2x 4...20 mA, potentially isolated against sensor circuit
	• Only for HART communication:
	  0.8...1.2 mA peak to peak	

Ex specification current output 4/20 mA	Intrinsically safe supply and signal circuit with type of protection: EEx ia IIC T6 passive	
	Max input voltage Ui Max input current Ii Max input Pi Max internal inductivity Li Max internal capacity Ci	30V 100 mA 750 mW 221 μH (output 1) 24 μH (output 2) 1.2 nF (output 1) negligible (output 2)

Connect a Liquiline M CM42 Transmitter

Use a 2-wire connection to the HART input module.

Housing Grounding

You must connect the 'Fixing plate' to the foundation ground with a separate functional ground line (2.5 mm2 i14 AWG).
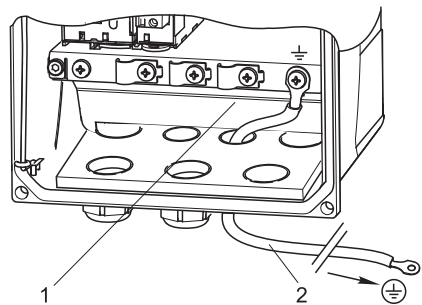
Item	Description
1	Fixing plate
2	2.5 mm2 (i14 AWG) functional ground

Stainless Steel Housing

You must connect the outer ground connection of the housing to the foundation ground with a separate line (GN/YE) (≥ 2.5 mm2 i14 AWG).
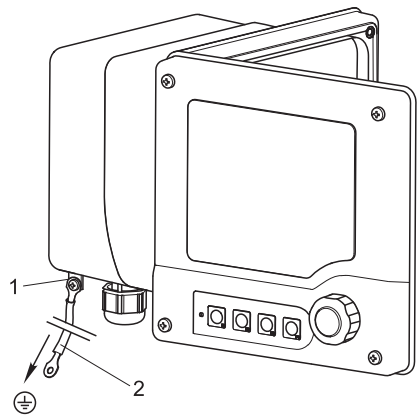
Item	Description
1	Outer ground connection
2	2.5 mm2 (i14 AWG) line (GN / YE)

Supply and Signal Circuit

For safe communication via the HART protocol and for compliance with the NAMUR NE 21, use a 2-wire cable that is shielded on each end. The second current output is an option.

Following are figures of the view in device (CPU module) (left) and the wiring diagram (right).
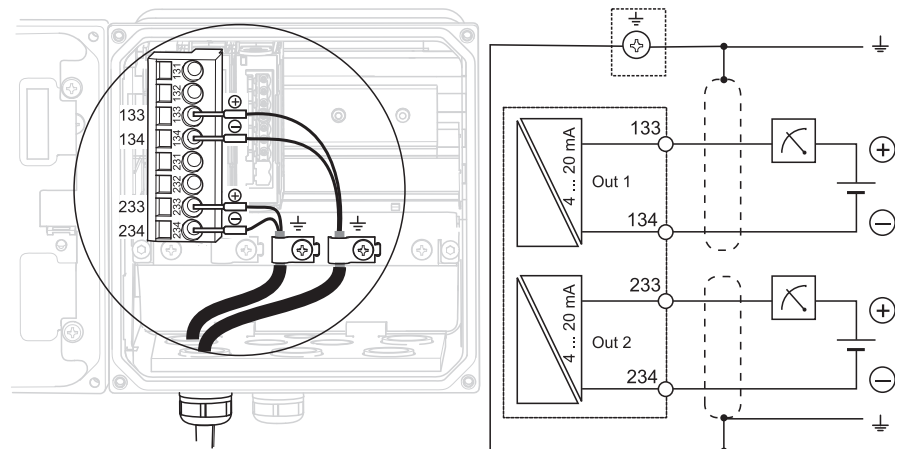
Sensor Connection: pH / ORP

Following are figures of the glass electrodes with PML (symmetrical) view in device (CPU module) (left) and wiring diagram (right).
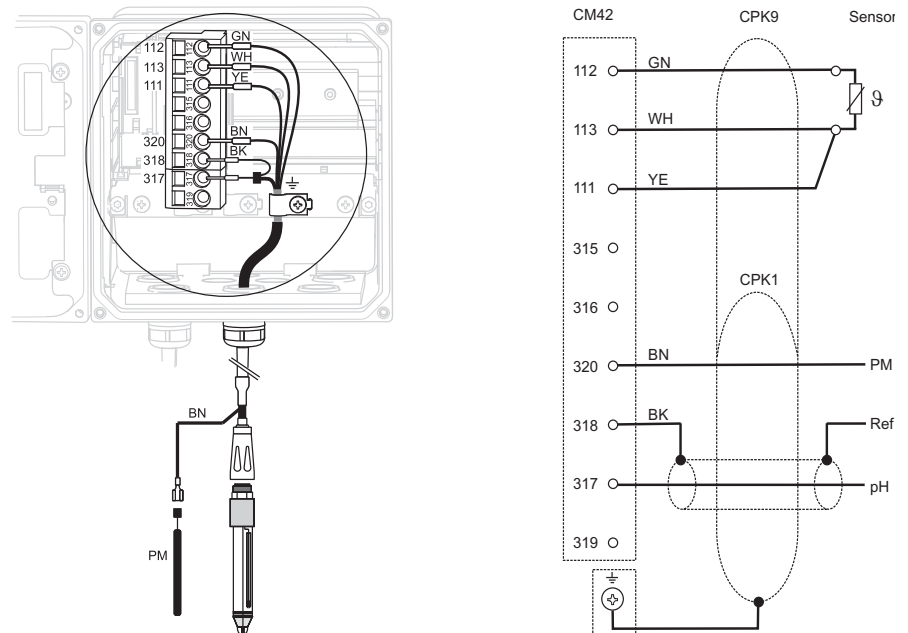
Following are figures of the glass electrodes without PML (symmetrical) view in device (CPU module) (left) and wiring diagram (right).
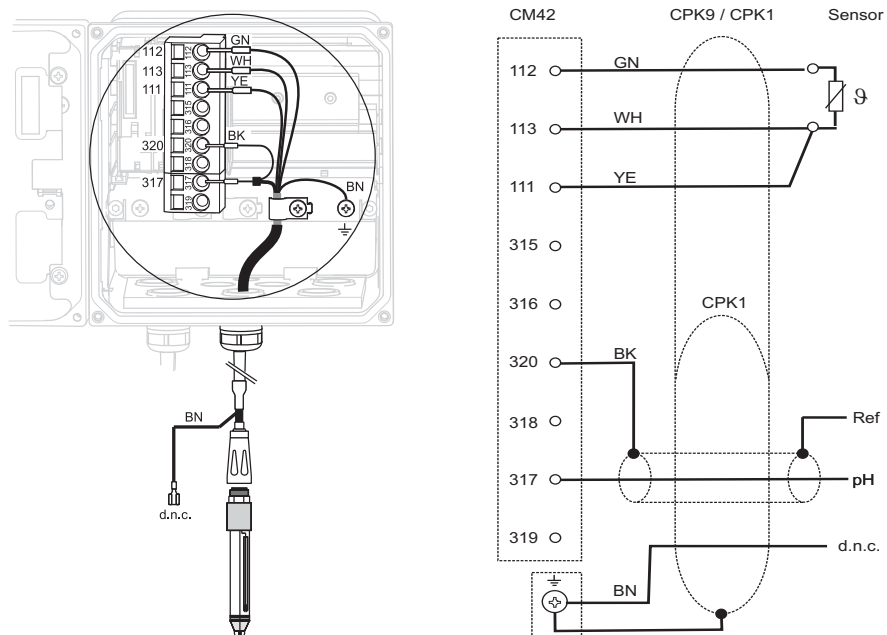
Following are figures of the ISFET sensors with PMI view in device (CPU module) (left) and wiring diagram (right.
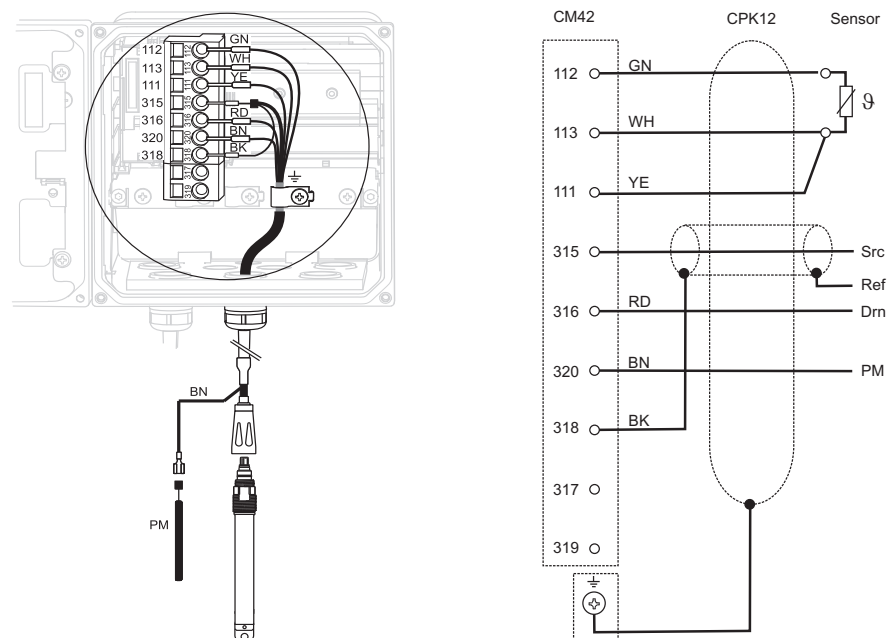
Following are figures of the ISFET sensors without PML view in device (CPU module) (left) and wiring diagram (right).
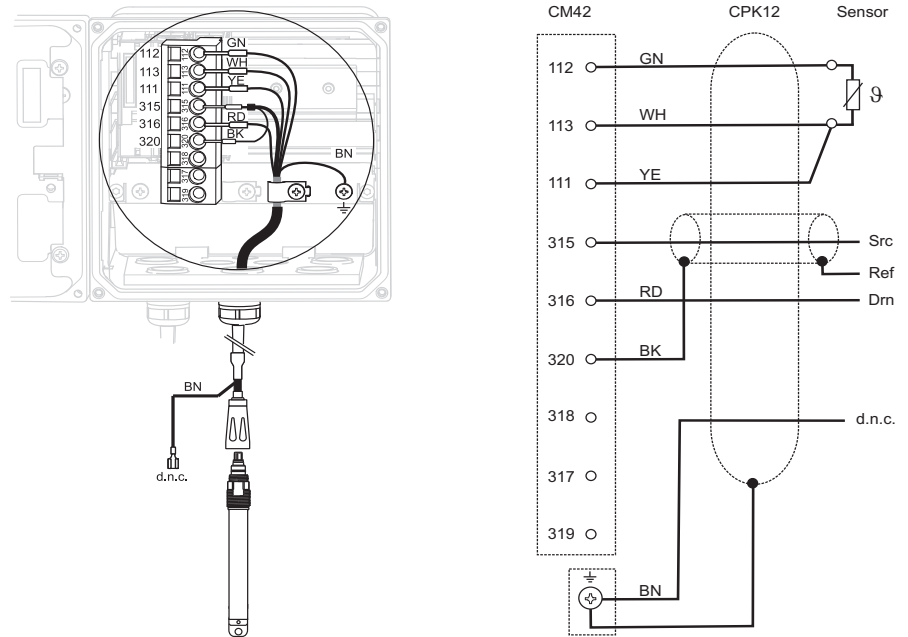
Following are figures of the Pfaudler electrode absolute wiring diagram (left) and the relative wiring diagram (type 18 / type 40 / Reiner) (right).
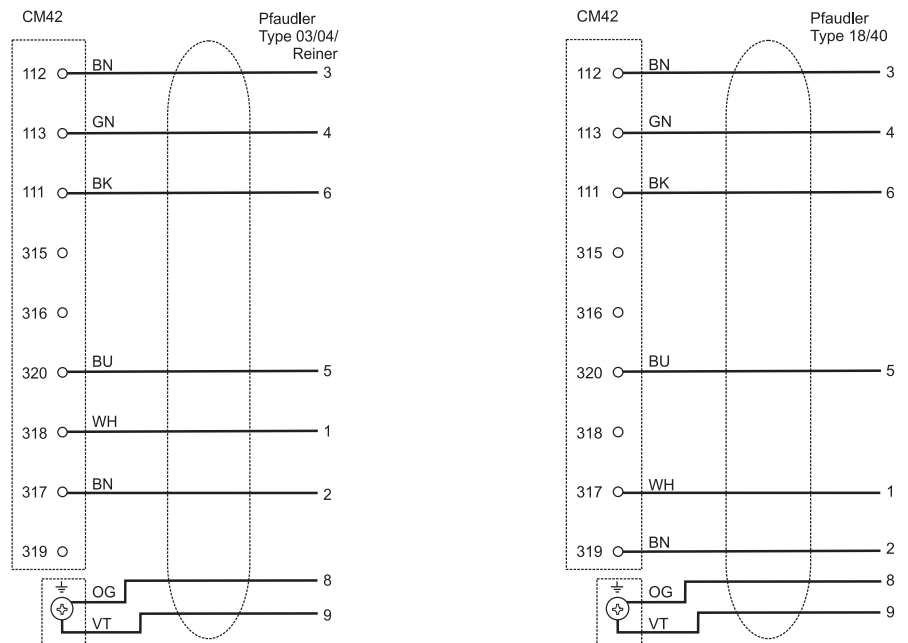
Sensor Connection: Conductivity

Following are figures of the conductive sensors, two-electrode sensors view in device (left) and wiring diagram (right).
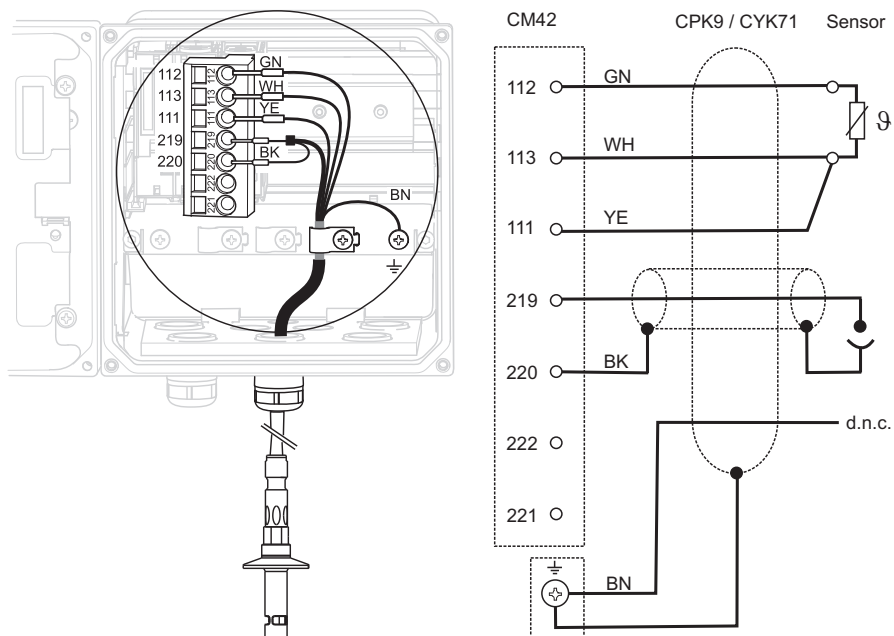

Following are figures of the conductive sensors, four-electrode sensors view in device (left) and wiring diagram (right).
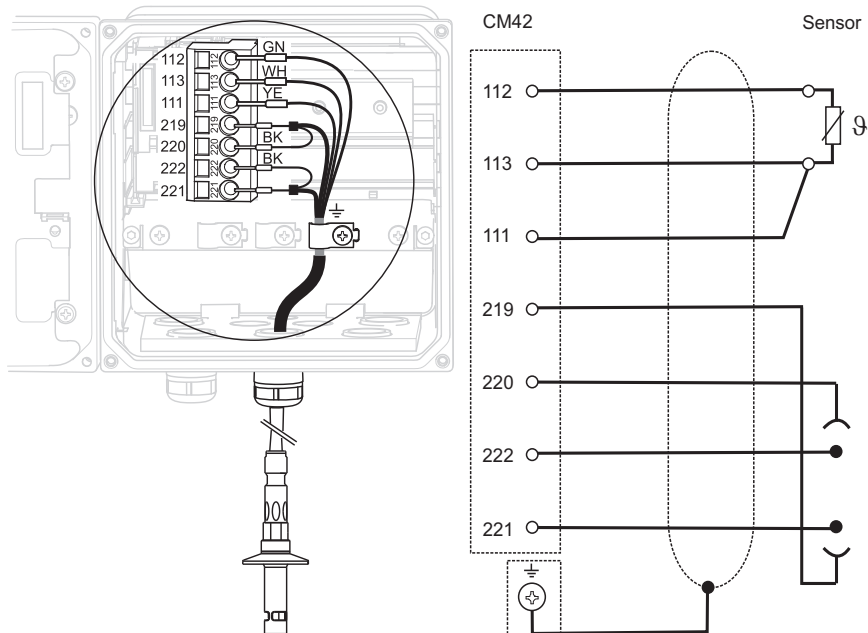
Following are figures of the inductive sensors view in device (left) and wiring diagram (right).
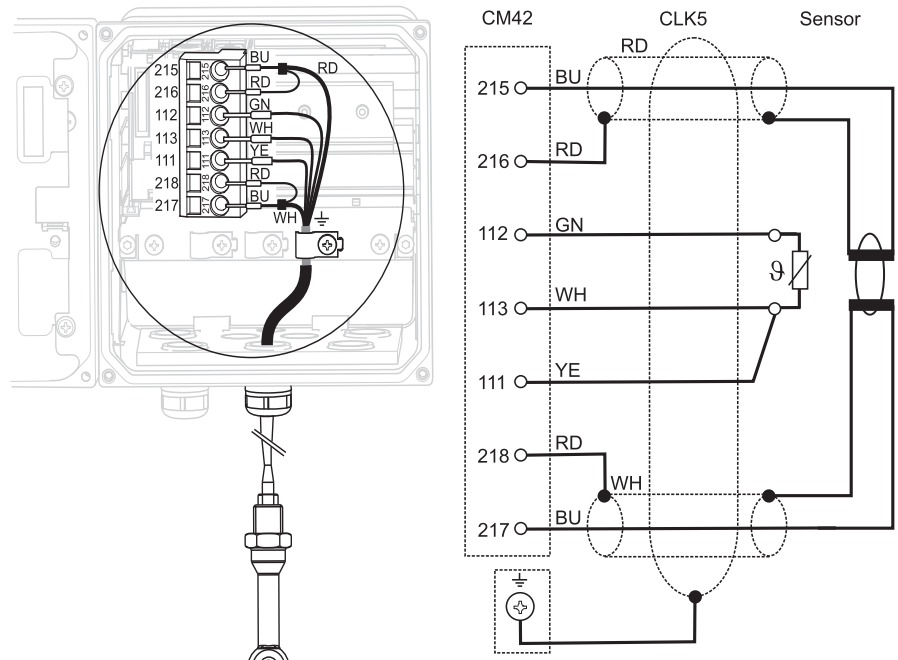
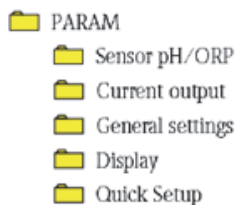## Sensor Connection: pH / ORP / ISFET / Oxygen (digital sensors)

Following are figures of the sensor connections: pH / ORP / ISFET / oxygen (digital sensors) view in device (left) and wiring diagram (right).
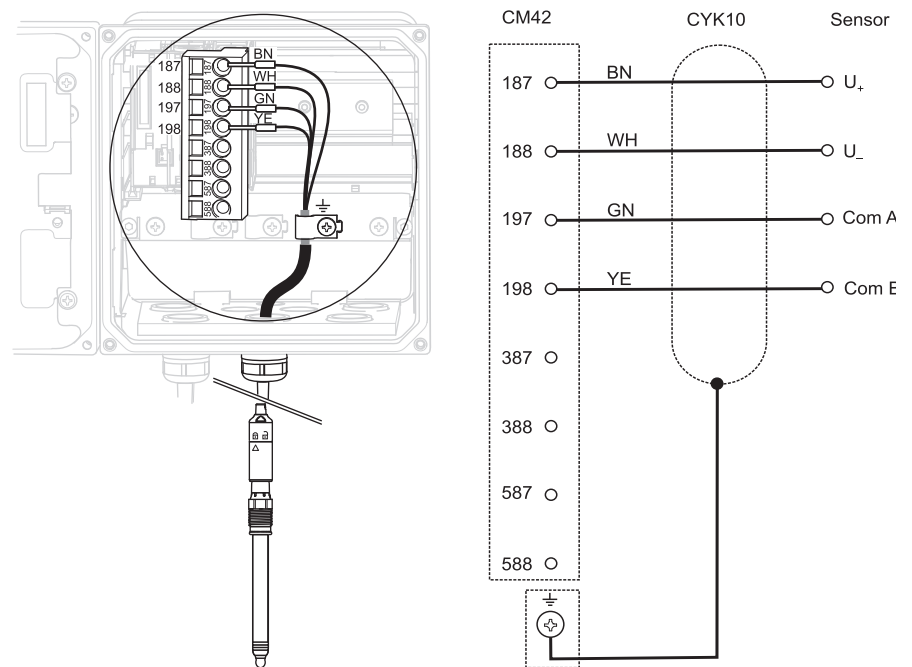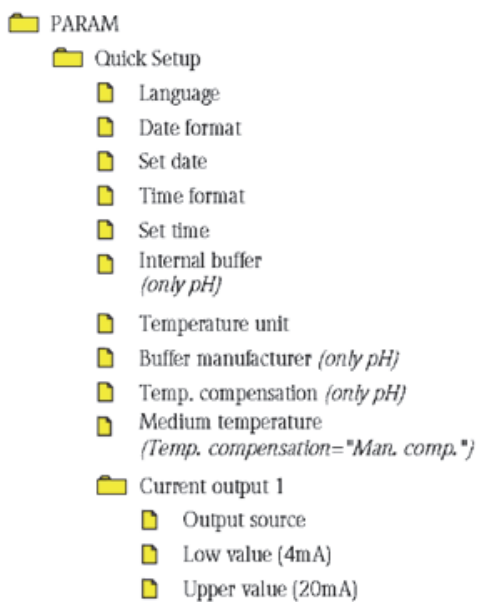
Configure a Liquiline M CM42 Transmitter

You can configure the device via the local display and menus on the instrument. On the local display of the field instrument, use the Quick Setup menus to configure instrument parameters.

Menu Structure, Top Hierarchy Level

📁 PARAM
    📁 Sensor pH/ORP
    📁 Current output
    📁 General settings
    📁 Display
    📁 Quick Setup

Quick Setup

📁 PARAM
    📁 Quick Setup
        📄 Language
        📄 Date format
        📄 Set date
        📄 Time format
        📄 Set time
        📄 Internal buffer
          (only pH)
        📄 Temperature unit
        📄 Buffer manufacturer *(only pH)*
        📄 Temp. compensation *(only pH)*
        📄 Medium temperature
          (Temp. compensation="Man. comp.")
        📁 Current output 1
            📄 Output source
            📄 Low value (4mA)
            📄 Upper value (20mA)

V

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W

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4-wire field instrument 21

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In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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